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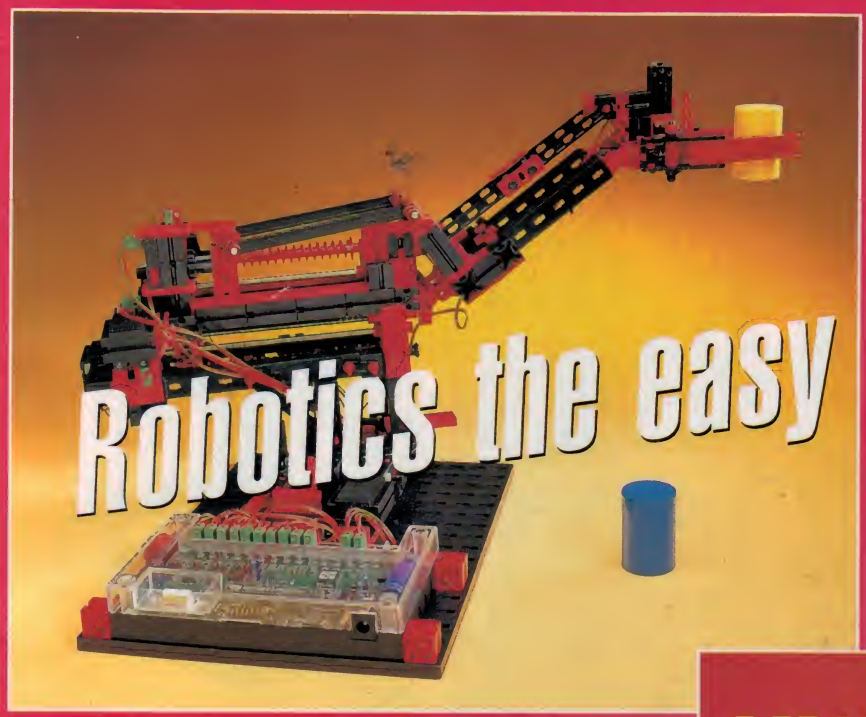

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If you want to build a robot, then why not do it the easy way? Check out our review of Fischer Technik's Industrial Robotics kit on page 24. Rob Evans looks at the self-powered Isobarik subwoofer kit from Jaycar - see what he thinks of this new design on page 32. (Photo by Michael Pugh)

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Professional Electronics

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Letters to the Editor

Grammatical slips

In the last issue or two of EA, I've noticed on a few occasions the incorrect use of the word 'aught' where 'ought' was intended.

Unfortunately the spelling is correct, so the spell-checker doesn't pick it up for you, though a good grammar checker should.

Despite these minor errors aught is not lost, and you ought to be congratulated on an excellent magazine!

Daniel Ford., (vai email)

Missing magnetism - 1

Re June 1999 Serviceman's column, and the disappearing magnetism. I remember many years ago seeing a demonstration of magnetising a mild steel bar by holding it in a North-South direction, and inclined at the approximate angle of magnetic declination for the location, then striking the upper end of the bar a number of times with a mallet. It didn't take long for the bar to become quite magnetised, and able to deflect a compass needle readily.

The thought came to mind, with reference to the problem with the high pressure washer, that perhaps it had been located for a long time in a position where the magnet in the flow sensor was in an approximate N-S direction; but that lately the machine was re-located so that the magnet was now E-W. It is quite likely that with the high pressure water flow there is a pulsating component, which results in small 'hammering' movement of the magnet. By being in a magnetic field in a similar direction, the magnet performed satisfactorily for many years, but when shifted, the continual hammering in a negligible (or even reversed) field has resulted in a comparatively rapid loss of magnetism in the magnet. Just a thought!

Keep up the good work. I look forward to each month's issue, as I have done for over 50 years.

Murdoch Finlay CPEng., MIEAust. (by e-mail)

Missing magnetism - 2

Reading about where the magnetism went (Serviceman, June issue) reminded me of the uneasy feeling I experienced recently.

For several years, we used a well known brand of kitchen kettle (made in China), the type with a small steel ball behind a window to indicate the water level. When new, it worked well. I presumed there was a magnet in a small float inside and never thought any more about it. Later I noticed the ball stayed at the bottom, but assumed it only needed a clean out inside.

It was only when the plastic of the kettle split and I was to discard it that I looked into why the level indicator had failed. I opened up the float and found no magnet — only a few grains of wet, black sand! The magnet appears to have broken down and dissolved. The manufacturer claims they have had no other complaints.

W.N., Penguin, Tasmania.

DVD region coding

In your Editorial Viewpoint (April 1999) concerning DVD and its region coding, in my opinion the matter is not as simple as it have may appeared.

The control by Hollywood's moguls is to protect their interests as you rightfully said. The context behind this is to ensure revenues obtained from movies are being protected against DVDs. Why should they promote DVD ahead of movies? The answer is obviously NO!

The sole reason for them to support DVD is *additional* revenue. So their aim is to release the movie first and the DVD next — not the other way round. To date *Titanic* is still not being released on DVD.

Hollywood does not want DVD owners in Australia to watch a movie on DVD ahead of the cinema. There are cases whereby a DVD movie is released ahead of a cinema movie. An example is *The Mask of Zorro*. A Region 1 DVD of that title was released a month ahead of the cinema movie in Australia.

This is one simplified view.

Michael Ong (via e-mail)

Interesting youth

I read John Rich's letter (July *EA*) about his effort to interest kids in electronics with some sympathy. Eight years ago before I moved to the country from a house in Melbourne where I had lived for more than 30 years, I decided to give away my huge garage-full of treasures. DC motors, AC motors, stepper motors, TVs, radios, tape decks, turntables, amplifiers, single-board computers, disk drives, printers, power supplies, plug-packs, displays, keyboards, dumb termi-

nals, cables, panel meters, hundreds of connectors and drawers full of ICs and components of every kind. There was even 20 years' worth of *EA*.

Nobody wanted any of it. I advertised in the local paper, put posters in local shops, visited the science teacher at every school within 10km and left a list with the local Dick Smith Electronics store. Somewhere, I imagined, there was a kid who would have looked around him and thought he was in heaven. No such kid turned up, and eventually I hired a fair-sized truck and made two trips to the tip.

I didn't know what to make of it then, and it still puzzles me.

Tony Turner (by e-mail)

VCR tuning

First let me thank Graham Cattley for the reply to my request for the web address of software to cool down PC CPU's. I found them very interesting — although as he suggested they wouldn't work on a 386 but worked wonders for my 486 running Win98.

Anyway the reason for this email is a response to the Serviceman with regards to the July article about the Panasonic VCR. It seems hard to believe that a tech of his long experience and knowledge has not seen this fault before. I live and work in Ingham NQ and see this fault with C3 every day of the week. Also the tuning problem is not a problem at all. His fatal mistake was not to read the owners manual.

The tuning procedure he was using is correct, but with one omission. While tuning up or down using the - or + buttons, he is only fine tuning — thus the long time it took to tune any stations. The procedure to tune is while holding the - or + buttons down, the 'Next' button has to be held as well. This puts the tuner in fast search mode. When a station is found then fine tune using the - or + keys.

I hope this info is of some use to the Serviceman or maybe other techs and readers.

Colin Leonelli (by e-mail)

Editorial Viewpoint

Who in their right mind would want to be an Engineer?

Computers have infiltrated our lives. They're on our desks, in our cars, in our homes. Computers have become an integral part of our society, and we have come to depend on them for practically everything, from cooking our food to designing our houses to keeping our cars running.

Because of their ubiquity, it's easy to take computers for granted; they're small, uncomplaining, and (in most cases) designed to seamlessly integrate into our day to day lives. But have you ever thought of what is actually happening inside that calculator? Inside that VCR? Inside the traffic control system that lets you get to work on time? Take a few minutes to consider, and you'll realise that it all boils down to one word: electronics. That's right, electrons flowing through conductors -- charge building up on capacitors, that sort of thing. Computers have evolved to a point where we treat them as abstract objects, not the end product of years of design, re-design, and mountains of equations, schematics, and machine code.

Somebody, somewhere had to design the beep-beep your telephone makes, and calculate the rate of deceleration of that lift carriage. These 'somebodys' are Engineers. Engineers working late, working to keep within budget, working to give their product a competitive edge in the market. But being an Engineer in the electronics industry isn't a glamorous job - the pay is lousy, impossible restrictions are placed upon you in terms of time and money, and what recognition can you expect for all your efforts? Practically nothing.

Take the case of the recently launched Intel Pentium III processor - lots of fanfare, lots of flashy graphics, lots of hype, stats and benchmarks, but no mention of the huge amount of effort put into the design of the thing. The hundreds of thousands of man-hours behind such a product are all but ignored when the product is released, and the general public usually has no idea of the hurdles that had to be overcome in getting that CPU into their machine.

You might argue that the general public doesn't really *care* about such matters - after all, they're the ones paying for it, aren't they?

I agree. However this brings me to the point of this editorial: Who in their right mind would want to be an Engineer? If we don't recognise the work put into the everyday things that we take for granted, then we are in great danger of soon not having any engineers at all. Anyone with a degree of technical interest will find it hard to resist the force from the 'dark side' - Information Technology, particularly when an IT manager can earn 10 times that of an electrical engineer.

What we need to be aware of is the technology that we use, and to appreciate the effort that has gone into creating it. The next time your brakes stop you 20ms sooner, or your mail gets delivered across the country overnight, stop and think of the people working away behind the scenes to make it happen. People working with (or against) the laws of physics to get you that faster processor, that more efficient engine or that more reliable pacemaker. Perhaps with a bit more recognition, more people might be tempted to take up Engineering (electrical or otherwise) as a career, and as a result, we'll all benefit.

Editor

WHAT'S new

in the ever-changing world of electronics

Mystere speakers from Q/W Audio Develpments

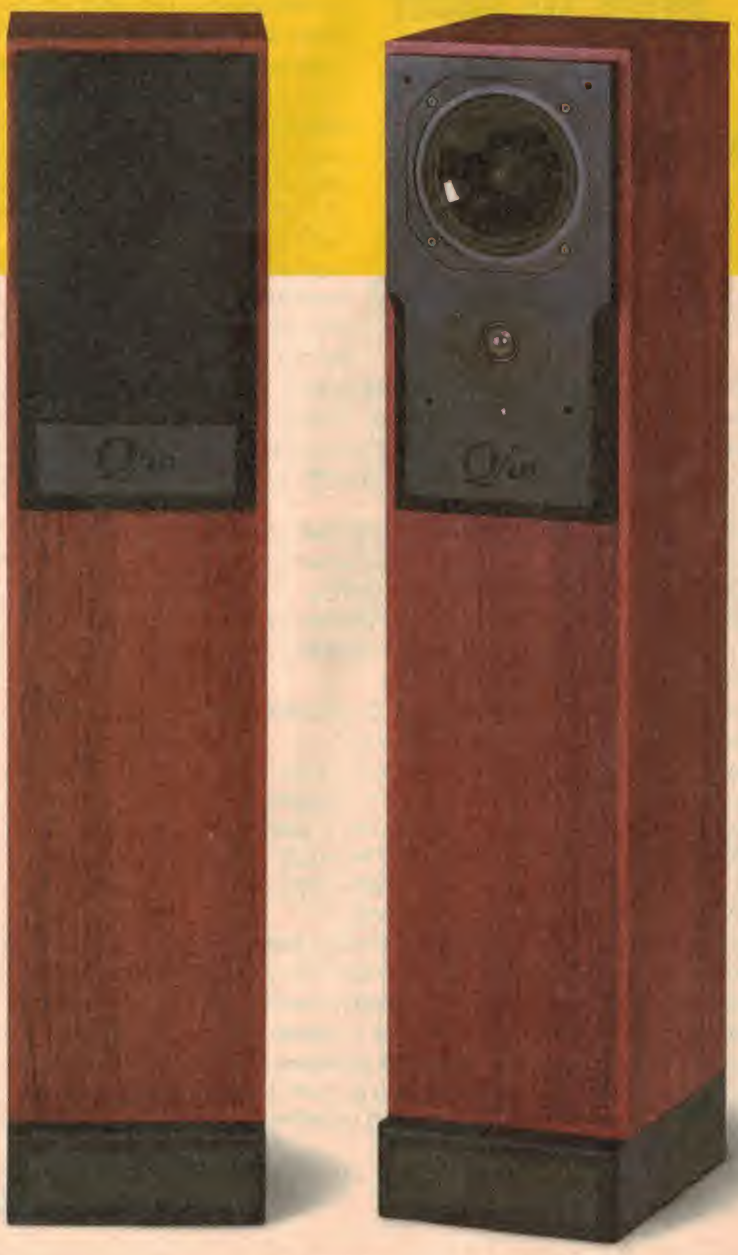
South Australian loudspeaker manufacturer Q/W Audio Developments has released a new model called the Mystere. The new design is based on the quarter-wave loaded line principle and is designed to appeal to the fastidious and discerning audiophile.

Measuring 1040 x 295 x 225mm (H x D x W), each substantial enclosure is finished in hand-rubbed Jarrah veneer and weighs 30kg. They also feature composite-layer panel damping for enhanced clarity and definition.

The main driver is a 170mm unit with a powerful magnet assembly, featuring a diecast basket with a 40mm edge wound ventilated voice coil and a high loss rubber phase plug weighing 2.57kg. The cone is made from TPX, an advanced polymer that is extremely light, very rigid and possesses high internal damping.

High frequencies are handled by a double-chambered 28mm soft dome driver featuring Hexatech voice coil for high power handling, a clear and detailed sound and superb transient response capability. Crossover is at 3.6kHz, through a first-order low pass and 2nd-order high pass network using audiophile grade components throughout, for an accurate and neautral yet musical presentation.

For more information contact Q/W Audio Developments, 5 Kelvin Road, Ingle Farm 5098 or call 1800 066 078.



Ultra-light notebook has desktop specification

Hitachi's new 220 Ultra-Lite Notebook sized computer combines sub-notebook size with full Windows 98 capability. Representing a brand new class (B5) in portable computing, the 220 Ultra-Lite weighs only 1.3kg and takes up the desk space of a B5 sheet of paper. At less than 30mm thick, it's claimed to offer the modern traveller the ultimate in personal computing and information creation ability.

This is not a Windows CE based machine. With an Intel Pentium 266MHz processor with MMX technology and 512KB of Level 2 cache memory, it offers incredible power. Apart from the Intel processor, it includes features generally found only on much larger portable and desktop units. These include a 10.4" active-matrix LCD display with 800 x 600 pixel resolution and the ability to use up to 262,144 colors. The inbuilt video card incorporates 2MB of SDRAM memory, supporting up to 1024 x 768 resolution using an external monitor. Further multimedia support comes from an integrated Sound Blaster compatible sound card with line-in jack, headphone jack, internal speaker and microphone.

More than a superb CD player...

Krell describes its new KPS25sc as the 'Krell Playback Solution'. It's an integrated CD transport, digital to analog converter and analog pre-amplifier, intended for high-end professional users and audiophiles.

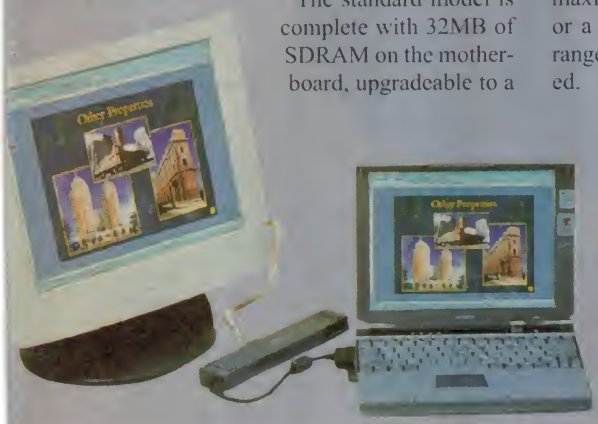
Features include a professional-grade CD reading mechanism with a high power neodymium direct drive spindle motor, a belt-driven laser mechanism and viscous damped suspension. The top-loading transport uses a disc clamp of precision machined and electrolysed aluminium for stiffness and low mass, held to the disc spindle magnetically. A piston-damped prismatic acrylic cover which swings down over the transport incorporates an electronic LCD shutter, which turns opaque during play to prevent stray light from entering the playback system.

The 16X oversampling digital-to-analog conversion system uses two high quality DACs and Motorola digital signal processors. An extremely stable low noise, low jitter master clock oscillator is used to synchronise all digital circuits, for superior audio signal quality.

Built into the KPS25sc is a reference-quality analog preamplifier with fully balanced class-A stages featuring Krell Current Mode circuitry, claimed to deliver exceptionally wide bandwidth with extremely low noise.

Frequency response claimed is from 0.1Hz to 1MHz (+0dB/-3dB), with an A-weighted S/N ratio of 97dB (balanced), channel separation of 97.8dB and THD figures of less than 0.005% at 1kHz and below 0.008% at 20kHz.

The Krell KPS25sc comes with both tabletop and handheld remote controls, and is available on indent only for $45,000. For more information contact Audio Services, 64 Burns Bay Road, Lane Cove 2066.



The standard model is complete with 32MB of SDRAM on the motherboard, upgradeable to a maximum of 160MB, and either a 3.2GB or a 4.3GB hard disk drive. A very wide range of connectivity solutions are included.

Battery power comes from a slimline Li-Ion battery with two hours operating life, or an optional 'extended life' five-hour battery for heavy-duty users.

The Hitachi 220 Ultra-Lite Notebook is available from dealers around Australia with a RRP from $4350 including tax. For more information contact distributor Digiland, 6 Expo Court, Mount Waverley 3149 (**www.digiland.com.au**).

WHAT'S new in the ever-changing world of electronics

World's first VCR for HDTV and standard TV

In the USA, Panasonic has released what it's claiming as the world's first high definition digital VCR — compatible with both standard definition (SD) and high definition (HDTV) digital television formats. Digital TV broadcasts began in major US markets last November, and currently more than 50 stations are broadcasting DTV signals.

The new Panasonic PV-HD1000 adopts the '5C' digital transmission content protection (DTCP) technology to safeguard copy-protected material transmitted via IEEE 1394 digital interface connections. It can be paired with the Panasonic DTV-certified TU-DST50 set-top decoder and can record all 18 ATSC formats, retaining the high resolution and vivid detail that DTV offers.

In addition to its digital compatibility, the PV-HD1000 is also a full-featured four head hifi stereo VHS VCR for standard NTSC.

Ultra-compact personal CD player

The new Philips AZ7883 Personal CD Player is claimed as an ultra-compact fusion of design and technology. In addition to a lean profile and sleek lines, it boasts innovative technology to ensure a smooth music experience, no matter how bumpy the ride.

Advanced features include 99 track programming, Dynamic Bass Boost and 45-second Electronic Shock Absorption (ESA), claimed unique to Philips. CD-Rewritable compatibility also enables the AZ7883 to play rewritable CDs, recorded on CD Recorders such as Philips Dual Drive CDR765.

An AC/DC adaptor and car kit keep the CD Player charged up and ready for action, while the built-in NiCad rechargeable battery allows for 14 hours of extended playing time. The AZ7883 comes complete with in-ear headphones providing a snug fit and outstanding sound quality. It has an RRP of $329.

Torch has novel 'oscillite' mode

Dick Smith Electronics has secured exclusive distribution for a new heavy duty torch — the Oscillite Flashlight, which can be used in normal spot mode or in a special 'sweep' mode which provides a beam oscillating back and forth through a 60° wide angle.

The Oscillite Flashlight has a waterproof rubber coated finish

Compact LCD projector has high light output

Hitachi Australia's new model CP-X935 compact mobile digital data projector has high resolution and brightness capability. Only taking up the desk space of an A4 sheet of paper, the new portable LCD-based projector weights in at only 4.45kg yet offers super bright output, ensuring the finest image even in high-light ambient conditions.

The CP-X935 features new 'Micro-Lens' technology from Hitachi that modifies the standard LCD panel — containing, or trapping, stray light and then focussing it onto the LCD panel. This results in a stunning 700 ANSI lumens of brightness from one very tiny box.

The projector's true-XGA resolution of 1024 x 768 pixels ensures that even the most finely drawn images can be projected right across the room with absolute clarity, ideal for complex CAD and technical presentations. By incorporating a new Genesis IC Hitachi has also been able to manage the fine re-sizing of characters and images when moving from compressed S-XGA down to VGA. No longer are characters confused when resolutions change. Hitachi also use the processor to offer the user an advanced Auto Set-Up function, making all messy manual adjustments a thing of the past.

An added bonus is the ability to zoom into important data on the screen, by a factor of four times. An image can also be 'frozen' on screen and discussed while the operator switches inputs.

Complete with IR remote control, the Hitachi CP-X935 is available from specialist presentation dealers for an RRP of $12,950 including tax.

"My computer is ringing your phone"

This odd-looking device is the MediaRing Talk, a new piece of software which is claimed to allow PC-to-phone voice communications anywhere in the world via the internet, and well as PC-to-PC calls. The PC-to-phone enhancement was co-developed by Ericsson and Delta Three Inc., a subsidiary of RSL Communications, and operates over the Ericsson IP Telephony platform deployed worldwide by Delta Three. Founded in 1996, Delta Three manages the world's largest international network dedicated entirely to the transport of Voice over Internet Protocol (VoIP).

which also offers a comfortable, secure grip. It also has room to house a spare bulb for emergencies or just easy storage. A battery indicator (green, yellow and red lights) shows the battery life remaining. Its heavy-duty lens and carrying strap make it a sturdy, useful tool to be used in any situation around the home, for camping, road emergencies and for those involved in Law Enforcement, Security and Rescue operations.

The Oscillite Flashlight is available for an RRP of $65 from all Dick Smith Electronics stores Australia-wide and DSE PowerHouse stores at Penrith, Bankstown and Moore Park in NSW and Carnegie in Victoria. It can also be purchased via mail order by calling Dick Smith Electronics Direct Link on 1300 366 644.

Tiny camera with wireless link

US home automation specialists X10 have released a new colour video camera that is not only very compact, but able to send its signals back to the TV or VCR via a wireless radio link which operates through walls and over distances up to 30m (100 feet).

The tiny X-Cam colour camera has an adjustable focus lens and connects directly to the matching VideoSender transmitter unit, which modulates the video on a UHF carrier at 2.4GHz. Also supplied as part of the set is the VideoSender receiver, which demodulates the UHF and delivers standard baseband video for recording or viewing on a TV. It's claimed to be ideal for unobtrusive recording of family events, domestic surveillance etc.

More information can be found on the X10 website (**www.x10.com**).

Digital time-lapse video recorder

High quality surveillance is an essential component of security systems, but getting a perpetrator on camera is only as useful as the quality of the image and the ease of accessing it. This is why digital time-lapse recorders are increasingly becoming the recorder of choice for such applications.

Mitsubishi Electric's new DX-TL110E Digital time-lapse Recorder offers advanced features including a high resolution of more than 400 lines, and recording capacity that can be increased from 4GB to 100GB by adding up to four additional hard disk drives with SCSI interconnection.

The DX-TL110E retrieves a requested image in seconds and is able to initiate a variety of searches, including date/time, alarm or character (data marked with optional comments). Digital recording also means the quality of recordings are maintained without loss of resolution or picture quality.

Storage and backup are made easy with media options such as hard disk drives, removable hard disk drives, magneto-optical disks or DDS tape drives. The integrity of the data is made secure by watermark technology on all recordings, which will allow detection of altered data.

The DX-TL110E features six different picture grades of moving JPEG compression, with three of the grades exceeding the quality of VHS recorders. It has 10 recording intervals, from 25 fields per second to one field every 16 seconds. The recorder is remote controllable via RS-232C. For more information, phone Mitsubishi Electric on (02) 9684 7777. ❖

Jamo's 'Apollo' Speaker System

Compact, unobtrusive SURROUND sound

BY JIM ROWE

Danish firm Jamo is Europe's largest speaker manufacturer, and well known for its excellent audiophile systems — many of them quite large and imposing. However its innovative Apollo surround sound system is designed for those who want high-quality 5.1 channel digital sound, *without* the large and obtrusive boxes.

Main components of the Jamo Apollo 5.1 system: five of their very compact Omega satellite speakers plus the SW 410E active subwoofer.

THANKS LARGELY to the advent of DVD video discs, there's currently a great deal of consumer interest in achieving surround sound reproduction in the home — especially the full 5.1-channel discrete digital surround sound, possible from many of the DVDs with Dolby Digital or DTS sound tracks.

But a potential problem for many home theatre enthusiasts is that they simply may not have the space for five or six full conventionally-sized speaker boxes. Or even if they do, their 'significant other' may not be happy with that much of the room taken up in this way...

But can you achieve good wide-range reproduction from such a multi-channel sound system, without having an array of rather obtrusive speakers? Yes, you *can*, and one way of doing it is by adopting the 'subwoofer plus satellites' approach. This takes advantage of the fact that because the wavelengths of bass frequencies are so long, they're essentially non-directional in a typical listening room.

In other words, even in multi-channel surround sound systems the bass frequencies are virtually 'mono' — meaning that if you wish, they can simply be extracted from the main channels and reproduced through one good 'bass' amplifier/speaker setup (the 'subwoofer'). This leaves only the more directional middle and upper frequency information for the various main and surround channels, and luckily this information can be reproduced very faithfully and efficiently using relatively small 'satellite' speaker boxes.

This type of system is somewhat harder to design for full wide-range operation than one with a full-range speaker box for each channel, because the response of the satellites must be carefully balanced with that of the subwoofer, especially in the crossover region. However when such a system *is* properly designed and correctly set up, the results can be very impressive.

Jamo's new Apollo surround sound speaker system is a good example of this subwoofer-plus-satellites approach. For this system Jamo's designers have combined one of their SW-410E active subwoofers with five of their very compact Jamo 'Omega' satellite speakers, to produce a surround sound system that's so unobtrusive that it should please even the most fastidious interior designer. At the same time, it's capable of providing excellent reproduction of surround sound, to please the home theatre enthusiast as well.

Needless to say it's the Omega satellites that are responsible for the system's minimal visual impact. These tiny boxes measure only 164mm high by 111mm wide and 100mm deep, with an almost cylindrical form which makes them look even smaller. Although they're made from solid 'pressure die-cast' plastic, they weigh only 870 grams, so they're also very flexible in terms of mounting. A small L-bracket and rubber buffer combo supplied with them can be used either for wall mounting or as a rear 'prop' for mounting horizontally on a shelf (or atop a TV for centre-speaker use), while a very slim and elegant matching floor stand (ST 75) is available as an option.

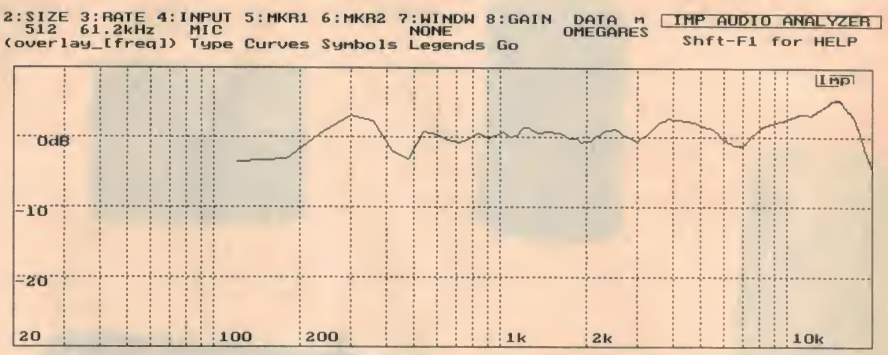
The Omegas are available in either black or white, by the way, to suit different tastes and room decor.

Inside each Omega there's a 95mm woofer/midrange driver with coated paper cone and foam surround, plus a 25mm dome tweeter with acoustic phase plug, to give smooth high efficiency reproduction from about 150Hz up. Both drivers are magnetically shielded so they can be placed near TVs and video monitors without disturbing them. Each Omega has a 70W short-term power capability.

In the Apollo 5.1 surround system, the subwoofer used to complement the five Omega satellites is the Jamo SW 410E, a compact and unobtrusive active subwoofer measuring 490 x 360 x 320mm and weighing 14.4kg. It uses a 254mm driver unit in a downward-facing bass reflex configuration, driven by an inbuilt 100W RMS amplifier which has a 'line level' input (10kΩ) and is provided with controls for adjusting sensitivity, crossover frequency (70 - 150Hz, 24dB/octave rolloff slope) and phasing (0 - 180°). The low-end corner frequency is rated as 35Hz.

The SW 410E has its own power cable and switch, with a small LED 'pilot light' on the front (the opposite end to the controls and connectors) to remind you when it's powered up.

As part of the Apollo system you also get a Jamo 'Connection Box', to help in connecting it all up to a typical amplifier system. The connection box is a small (92 x 80 x 33mm) passive device with terminals to allow it to be connected in series with the leads from the amp to the front left and right satellites, and an RCA socket which extracts the bass signal for the SW 410E. With the box there's also a shielded RCA-RCA connection lead (about seven metres long) to use between the



The on-axis response of one of the Jamo Omega satellite speakers, measured at 1m using our IMP system. There's no sign of any irregularity in crossing between the 95mm midrange driver and the 25mm dome tweeter speaker; in fact for such a tiny enclosure it's commendably smooth and well balanced.

Connection Box and the subwoofer input, allowing you to have the latter in virtually any convenient 'out of sight' location.

In the SW 410E manual Jamo suggests that it can be placed against a wall, say between the two front speakers (i.e., under the TV/screen), or over in a corner of the room. It comes fitted with sturdy plastic feet to raise it about 30mm above a hard floor, with a set of screw-in spikes to raise it further on carpet or similar soft/absorbent floor covering, to allow unobstructed dispersal of sound from the driver and bass reflex port.

In all, the Apollo system is a very neat and classy example of the 'active subwoofer-plus-satellites' approach to surround sound speakers, with a reasonably attractive price tag of $1799 for the complete set. The optional ST 75 floor stands for the Omega satellites are available for a further $149/pair, in either black or white to match the speakers themselves.

Incidentally the Omega satellites are also available separately for $399 for a pair, or $598 for a set of three. In addition the SW 410E active subwoofer is available separately (including Connection Box) for $999. Or if you prefer to use the Omega satellites with a *passive* subwoofer, there's an alternative set available with an SW 250 (2 x 200mm drivers) subwoofer which sells for $999.

Trying it out

Jamo Australia sent a complete Apollo system for evaluation, allowing us to try it out with a Pioneer VSX-D906S Dolby Digital/THX Surround Receiver, coupled to a Kenwood DVF-5010E DVD/CD Player. This made it possible to play all of our favourite reference CDs and clips from DVD movies, to get a good idea of its performance in a 'subjective' sense.

We were also able to run a quick check over the Omega satellites with our IMP PC-based testing system, to examine their objective performance. As the on-axis response plot shows, for such a tiny enclosure they certainly gave a very good account of themselves. The response was flat within +/- 1.2dB from about 400Hz up to over 3kHz, with a gentle rise to about 2dB at 4 - 5kHz, a minor dip at 7kHz and then a gradual rise to just over +5dB at 15kHz, before drooping to hit the -3dB mark at around 20kHz. Even at the low end the response was still about -3dB at 180Hz, suggesting that the Omegas were going to mate very well with the SW 410E when it has its crossover frequency set at the high limit of 150Hz.

Setting up the complete Apollo system for listening to CDs and watching DVD movies was quite straightforward. Since we were using the bass tap-off on the Jamo Connection Box to drive the SW 410E subwoofer, we were able to set the crossover frequency to maximum (150Hz) to suit the Omegas, and it was quite easy to set the subwoofer sensitivity and phasing for correct balance and best low-end reproduction using the 'setup' mode in either the Pioneer Receiver or the Kenwood DVD player, with their white noise signals.

The end results here were very impressive, too, on both CDs and excerpts from representative DVD movies. The Omegas gave very clean and transparent middle and high-end sound, while the transition to the SW 410E was smooth and without any obvious 'bump'. The SW 410E then gave nice warm bass down to the 35Hz mark and beyond. Even on movie passages such as some of the well-known 'action' scenes in *Terminator 2*, the sound was very clean and full — yet free from obtrusive thumping.

Overall, then, we found the Jamo Apollo 5.1 system very impressive. Despite the tiny size of the Omega satellites, it's capable of delivering quite convincing 'big system' sound in a typical home theatre environment — thanks to that SW 410E active subwoofer and the way it can be adjusted to complement the Omegas.

So if you want satisfying home theatre sound without a roomfull of big speakers, this one is well worth considering. ❖

Jamo Apollo 5.1 Speaker System

A compact and unobtrusive 'subwoofer plus satellites' system for 5.1 channel surround sound.

***Good Points**: Compact but 'beefy' woofer, tiny satellite speakers; good tonal balance and crisp but smooth sonic performance.*

***Bad Points**: Nothing significant.*

***RRP**: $1799*

***Available**: Jamo Australia Pty Ltd, 1 Expo Court (PO Box 350), Mt Waverley 3149; phone (03) 9543 1522 or fax (03) 9543 3677.*

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Megapixel cameras: the resolution is rising

Well, they've arrived! Since looking at Kodak's two-megapixel digital cameras in the July issue, a number of other contenders have appeared on the market from Sony, Ricoh, Olympus, Nikon and Fuji. We take a look here at what they offer, and how they compare.

BY CHARLES GOMER

Digital photography for the masses moves on: now, a number of consumer digital cameras have reached the 2MB level in pixel-packing their CCDs. What next? Higher resolution or lower prices?

Perhaps you shouldn't hold your breath on the latter, but market pressure could see a fall from the present $2000 level to a more attractive $1500 altitude within a year. As for the former, 2MB is a good place to be for a number of reasons.

For one, a print made from a two-megapixel camera image can now hold its own with a compact camera film shot up to a 5x7 inch print size. And, at the correct viewing distance (say two to three diameters) a digitally-originated A4 print will satisfy any but the most critical.

Large file size

A factor against the acceptance of 2MB cameras is in the size of the resulting file, and the storage thereof. A 2MB camera image will generate an image with a resolution of around 1800 x 1200 pixels; then, with minimal in-camera JPEG compression that same picture will exit the camera at around 800k.

Digital images of that 'weight' do take some time for the camera's internal microprocessor to handle — to the mounting annoyance and confusion of the user, accustomed to the mechanical instancy of a compact film camera. Not only do the millions of pixels that constitute the image have to be extracted from the CCD, but they then have to be converted into an RGB image, compressed to a JPEG file, and then written to storage.

Storage can mean a memory card (such as CompactFlash or SmartMedia), which is a ponderously slow way to stash the relatively large digital files. On one current 2MB camera — the Ricoh RDC-5000 — there are two options: an internal 8MB of RAM or a slip-in SmartMedia card. The internal RAM is so fast that the camera is capable of shooting up to one frame per second. But internal RAM is expensive and not expandable. So, at the end of the digital shooting day, the big file sizes of the 2MB cameras face a speed bump.

Now let's look at the entrants in the 2MB event, including contenders from Fuji, Sony, Nikon, Olympus and Ricoh.

Fujifilm MX-2700

With 2.3 million pixels (2.16 million effective) packed into its 14.9mm image sensor, the first Fuji camera to pass 2MB has every-

thing going for it, except for the lack of a zoom lens. The maximum resolution available is 1800 x 1200 pixels — presenting a 3:2 aspect ratio similar to that of a 35mm frame.

Where the camera wins against the competition (other than Sony) is by its use of a proprietary lithium-ion battery, which lets the user fire off 250 shots on a single charge. Other models using NiMH and NiCad cells need not apply!

A generous 2" (50mm diagonal) LCD finder dominates the camera's rear face — itself only 80 x 97.6mm in size. Following on company policy (and that of Olympus as well) the MX-2700 uses the SmartMedia card for image storage. The camera offers two resolution figures (1800 x 1200 or 640 x 480 pixels) at three compression levels. There are also more than adequate controls for adjusting white balance, exposure compensation (from -0.9 to +1.5 f-stops) and flash power.

Flash is likewise variable: by +/- 0.3 or 0.6 increments to a limit of two f-stops plus slow sync for night scenes. It's a surprise then, to learn that the lens is fixed focus. In playback mode you can ring some changes with your stored images and transform them to a mono, sepia, sliver crossed (with highlights on an image) or rainbow (coloured highlights) result. And that's before you get to the software! Price: $1899.

Opposite page: The Olympus Camedia C-2000, fully configured.

The Fujifilm MX-2700. It's neat and compact, but there's no zoom lens.

Olympus Camedia C-2000 Zoom

As usual with Olympus, its 2MB entry is a serious contender, and not in the least for the quality of the their lens systems. The C-2000's 1/2" CCD captures a maximum resolution of 1600 x 1200 pixels, totalling 2.1MB. The zoom is an f2.8 lens of 6.9-19.5mm range (equivalent to 35-105mm on a 35mm film camera). Shutter speeds run at 1/2 to 1/800 sec.

Exposure modes include program, aperture or shutter priority. The flash system is multi mode and offers sophisticated first or second shutter sync for some nice blurred motion effects; the flash socket is identical to a PC terminal on a film camera, and there is also an external terminal for an outboard flash unit. Metering can be made as an overall reading or in spot mode.

Instead of offering a gain up and down in image sensitivity, the camera indicates the correction in terms of film speed: ISO 100, 200 or 400. But there is still aperture compensation of +/- 2 stops. A two frame per second mode is available too. The C-2000 sports a 45mm LCD viewfinder, and uses the SmartMedia card for image storage. It is priced at $2299.

Picture taken with the Fujifilm MX-2700.

You can expect excellent macro facility from the Nikon CoolPix, down to 20mm in this shot.

Nikon Coolpix 950

This company has marketed a number of recent models using a swivelling lens turret; the 950 follows this tradition. The purpose of this arrangement is to allow the photographer

(digigrapher?) to line up the shot whilst simultaneously rotating the body-mounted LCD finder to get a viewable picture - it seems though that no-one has yet solved the problem of the LCD's image suffering from 'washout' in daylight.

The camera's maximum resolution is 1600 x 1200 pixels capture by a 1/2 inch CCD with a total capacity of 2.1 MB. There is a choice of ISO ratings, like the Olympus, variable between 80, 100, 160 and 320. The lens has a maximum aperture varying from f2.6-f4, depending on lens focal length, which varies (in 35mm equivalent) between a wide 38mm to tele figure of 115mm.

There is also a digital zoom (actually a mere enlargement of the image's pixels),

The Nikon CoolPix has an interesting configuration, with comprehensive exposure control too.

ranging along 1.25X, 1.6X, 2X, 2.5X. The shutter varies from eight seconds to 1/750 sec. Exposure adjustments can be made two stops up or down in 1/3rd increments. Metering is via a matrix, centre-weighted or spot system.

The flash unit has the usual modes (auto, flash forced in, off etc.) plus an external flash terminal. A continuous shooting mode will fire off 1.5 pictures in each second. There are four quality levels — high (TIFF), fine, normal and basic. The LCD viewfinder is a 2 inch job. Memory card is CompactFlash. Price: $2299.

Ricoh RDC-5000

Impressively for this company's first two megapixel camera, the first two shipments sold out on arrival. In design it looks just like a film compact camera — even to the sliding lens cover. A welcome addition is another sliding blind over the rear LCD finder, an area often prone to greasy fingerprints.

The zoom has only 2.3X optical power but a 2.5X digital enlargement can be made. The camera is also the first to offer auto focus continuously from 40mm to infinity — no more macro mode. The company boasts of the lens' 200 lines/mm resolving power which is important when you learn the CCD has a diagonal measurement of only 1/2 inch.

The RDC-5000 is also the first on this market offering a USB connection to the computer as well as the usual serial link. As we mentioned earlier, the camera has 8 MB of SDRAM internally, and is sold without a memory (SmartMedia) card. It is possible to shoot a prolonged burst of frames at one per second - at the top resolution of 1792 x 1200 pixels.

Besides this resolution there is also an 896 x 600 pixel mode. Either of these can be shot with one of three JPEG compression levels, with the top file size being around 800KB.

Excellent detail captured by the Ricoh RDC-5000.

It looks like a film camera and performs like one. The Ricoh RDC-5000 can focus from 40mm to infinity.

At lowest resolution and maximum compression, the 8MB of internal RAM can store 99 shots. It is possible to transfer any images from card to memory or vice versa. Interval shooting is provided for on the RDC-5000 as well as a range of picture modes: monochrome, sepia and text. Price: $1999.

Sony DSC-F55E Cyber-shot

In spite of its mature age Sony often acts like a runaway colt (and I mean this in the nicest way). This digital camera is an example of the independent thinking which goes on at the S company. For a start, the DSC-F55E Cyber-shot looks just like an electric shaver, complete with rotating head! The swivelling head is actually the lens mount and can traverse 180 degrees fore and aft.

The compact Sony DSC-F55 can shoot movies and stills. It's Windows only, so bad news if you've got a Mac...

What is more surprising is that the camera not only presents a CCD with 2.11MB picture quality, but it can also record movies. The 1/2-inch CCD with an effective pixel count of 2.02 million can capture an image of 1600 x 1200 pixels at maximum resolution. The Zeiss Distagon lens has an f2.8 aperture and a fixed focal length of 6.85mm.

The memory format is Sony's own Memory Stick, storing up to 260 still images in JPEG format, or MPEG1 for movies. The MPEG Movie function lets you record up to 10 min. 40 sec worth of images. As mentioned earlier, the camera uses Sony's InfoLithium battery, so ensuring extended shooting action and a fully powered up LCD screen for viewing.

Sony is so confident of the battery's longevity between charges that there is no optical viewfinder. Fine, you may say, but in spite of all attempts to the contrary, the LCD finder is still difficult to view in full daylight. Although Sony describes the 'hybrid' LCD screen as a 'transmitting/reflecting' device, it is in reality a backlit screen.

Cabling and software are for Windows only, so no Mac support. An odd omission when you learn that there are only two or three digital still cameras (out of 40 plus) on the Australian market which are Windows only. The bundled software is Picture Gear 3.2 Lite for Windows 98/95/NT 4.0. Price $2099.

Bigger is better

When the shooting is all over, 2MB may sound like just another figure — a spec to be lauded by the marketing people, but you can't avoid noticing the difference in quality the moment that 2-megapixel image first splashes up in the monitor. And, until the buyers clamour for more, it would appear that 2 or maybe 2.5 million pixels will do just fine for the moment. Let's just hope the prices fall.❖

This figurehead was spectacularly captured by a Sony DSC-F55.

Reaching for the SKAI

BY GEOFF MCNAMARA

You're no doubt aware that some really big radio telescopes have been built in the past, often composed of an array of smaller antenna dishes. But there are plans afoot to construct one that can rightfully claim to be the biggest single telescope in the world, with a collecting surface area of one square kilometre...

Radio astronomy is set for the next major advance in instrumentation. Recognising the limitations of present day radio telescopes for pushing back the astronomical frontier, an international consortium of radio astronomers is planning the largest radio telescope in the world. Dwarfing anything previously designed, the telescope will have a total collecting area of one square kilometre.

The proposed telescope is appropriately called the 'Square Kilometre Array Interferometer', or SKAI. SKAI is needed to allow astronomers to study fundamental phenomena such as the formation and evolution of galaxies, extreme states of matter within black holes and neutron stars, and for the search for extraterrestrial intelligence. SKAI's sensitivity, say its designers, will have to increase at least an order of magnitude beyond the capabilities of contemporary instruments if more is to be learned about these exotic phenomena.

As is the case in optical astronomy, telescope capability is a combination of receiver sensitivity and collecting area. Fantastic advances have been made in receiver sensitivity and allied functions such as software control and interference filtering. However, it's widely agreed that future advances in telescope performance will result mainly from increases in collecting area. In other words, the bigger the better.

The largest radio telescope on Earth is the 300 metre Arecibo telescope built into a natural depression in the hills of Puerto Rico. Although large, it suffers the disadvantage in that it cannot be steered fully about the sky. As it stares upwards, the Arecibo telescope can only observe a relatively small band of the sky that passes overhead each day.

In contrast, fully steerable telescopes like the famous 64 metre Parkes radio telescope in western New South Wales are able to look at a much greater portion of the sky. But such pointing ability comes at a cost: size. The support structures needed to swing huge steel dishes around the sky become enormous and prohibitively expensive. The largest fully steerable radio telescope is the 100 metre Effelsberg radio telescope near Bonn in Germany, and it's unlikely this record will ever be broken. (Note that the US National Radio Astronomy Observatory, at Greenbank West Virginia is also constructing a 100m steerable reflector. It will have an off-axis feed and hence will be more efficient than the Bonn reflector.)

Different approach

Clearly, in order to build a telescope with a collecting area of a square kilometre calls for a different approach. Currently there are a number of proposed designs, each being researched by institutions that have signed a 'Memorandum of an Agreement' to investigate the construction of the telescope.

Astronomers and engineers from the Australia Telescope National Facility (ATNF), for example, are studying a phased array. This design would have the advantage of independent multibeaming and exceptional flexibility when it comes to suppressing radio interference. While this design is ideal for longer wavelengths, at shorter wavelengths the number of dipoles needed becomes prohibitive, and so it's envisaged that some type of field concentrator — in the form of small dishes, large, flat reflectors, or even an

An artist's impression of the proposed phased array.

Arecibo-type dish — would be added.

An alternative to this design involves an array of 30 large, low-profile reflecting surfaces with relatively long focal lengths. Each reflector would have adjustable panels and a tethered balloon carrying a receiver at the focus. This design, being studied by astronomers at the Herzberg Institute of Astrophysics in the National Research Council of Canada, eliminates the limitations of a phased array at shorter wavelengths.

Both the SETI Institute and the National Centre for Radio Astrophysics in India are studying the use of arrays of fully-steerable small to medium-sized parabolic dishes. Chinese astronomers are investigating the possibility of building an array of single reflectors similar to the Arecibo telescope.

Although studies have been continuing for several years, there is no clear winner. "At this stage, we are still encouraging diversity of proposals in order to maximise opportunity for innovative solutions," said Professor Ron Ekers, Director of the ATNF. "The next step will be for various players to prototype key components for evaluation in 2002-3."

While these designs might appear widely different, Ekers points out that an early decision is not as critical as it might seem at first. "Most of the telescope design is the same for all options... It is also quite possible that the pure phased array may be used at longer wavelengths and the concentrators at shorter wavelengths, and all this could be combined in a single telescope," he said.

Building SKAI is something no one country can afford, hence the international collaboration. Don Morton, Director General of the Herzberg Institute of Astrophysics, explained that the cost of the project would be shared amongst a number of countries, each being afforded a portion of observing time in proportion to their financial contribution. Morton points out, however, that the major challenge facing the project is driven by economics. "The fundamental challenge is finding a technology that will provide a square kilometre collecting area for a price that the partners can afford — say $US200 million," Morton said.

Where do you want it?

With so many countries contributing to SKAI, the next question is where to put it. "It would be very good to have both southern and northern hemisphere arrays and to have them at significantly different longitudes," Ekers explained.

With a telescope in both hemispheres the entire sky could be observed with equal clarity. Further, placing the telescopes at different longitudes would provide continuous coverage of phenomena that vary over time, and would also provide large collecting area ground stations for space VLBI (Very Long Baseline Interferometry. See Electronics Australia, December 1995). Such advantages may even mean sacrificing collecting area, says Ekers. "It may be worth halving the size to build two," he said.

Assuming astronomers decide that it's better to stay with one telescope, Ekers says the Southern Hemisphere has some astronomical advantages. Morton agrees, pointing out that for one thing, access to the centre of the Milky Way is easier from the Southern Hemisphere.

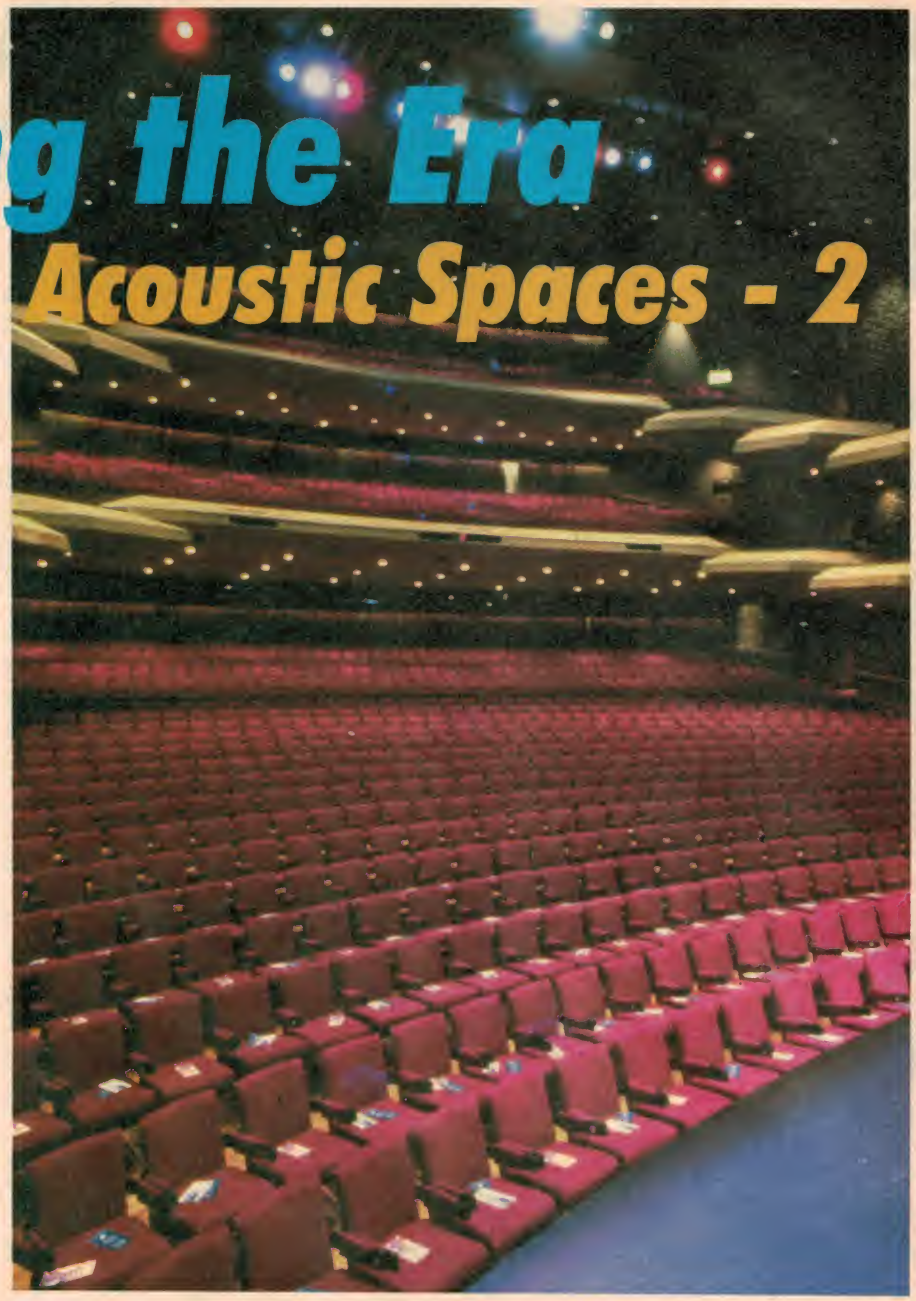
Two possible southern sites are the Atacama Desert in Chile — where the US and European institutions are hoping to build a submillimetre interferometer — and outback Western Australia. "A working group is now establishing the criteria for site selection," Ekers explained. "Other factors will include low population density, not too far (say no more than 30 degrees) North or South, accessible site with benign weather. There are locations in Australia which satisfy all these conditions."

Whatever, and wherever, SKAI turns out to be, it will carry radio astronomy well into the next century. Complementing other major international projects such as the Next Generation Space Telescope (an eight-metre class successor to the Hubble Space Telescope), SKAI will help fill holes in our understanding of the Universe created by the fantastic strides in instrumentation that have taken place in the twentieth century.❖

What's in a Name?

SKAI is also known among members of the consortium as the 1kT for '1 kilometre Telescope' (favoured by Australian astronomers), SKA for 'Square Kilometre Array' (Canada), LT for 'Large Telescope' (China), and OSKAR for 'One Square Kilometre Array' (US). The consortium admits that "a future issue is to converge to a common name".

Entering the Era of Virtual Acoustic Spaces - 2



BY JOHN MATHESON

In this second of his two articles on virtual acoustics, John Matheson gives a practical example by describing how the Festival Theatre in Adelaide was given 'the treatment'

ODDLY ENOUGH, THIS story begins with Grand Prix racing and finishes with Wagnerian opera! Adelaide is better known for its churches and international arts festival than motor sport. However in 1985 it became the first Australian city to host a Grand Prix race in the modern era, through city streets and parklands.

In 1996, to the embarrassment of local politicians, the race relocated to Albert Park in Melbourne. It took with it tourist and business revenue, said to have brought several hundreds of millions of dollars into the state economy. The government of the day then reinvented the highly regarded Grand Prix Board (organisers of the race event) as The Major Events Corporation, with a charter of providing seed money for the staging of major events that would bring a net benefit to the local economy.

A consortium consisting of the Adelaide Symphony Orchestra, The State Opera Company and The South Australian Major Events Corporation procured the rights to stage the Paris Thiater du Chbtelet's version of the entire *Der Ring Des Nibelungen*, Wagner's epic cycle of operas. The Ring Cycle, which had never been fully staged in Australia before, was scheduled for the Festival Theatre in November 1998.

There was a great deal of concern that the much maligned acoustics of the theatre would not please the high ticket price paying patrons (around $1000 each). Acoustical refurbishment of the theatre was considered paramount. At the same time, it was important to retain or enhance the theatre's suitability for both amplified music and orchestral concerts. No architectural acoustical solution could meet these divergent requirements.

The 2000-seat Festival Theatre auditorium had an acoustic behaviour that provided good, even coverage for speech, contemporary music concerts and musicals. Its reverberation time was long at low frequencies, short at middle frequencies and very short at high frequencies for its size. Low frequency resonance sometimes caused problems for sound engineers.

When it opened in 1973, it was regarded as an acoustically innovative design for its system of retractable acoustic curtains along the rear walls and above a false ceiling. The design of the ceiling was intended to promote reflections back to the auditorium, whilst still being open enough to allow the development of reverber-

ant energy in the volume above, which could filter back down to the auditorium.

After being in operation for some time, the theatre came to be regarded as having less than satisfactory acoustics for symphony orchestras, and to a lessor extent opera, primarily because of its excessively short middle and high frequency reverberation time. Performers on the Festival stage derived little support from the auditorium, which gave them a poor impression of their performance.

After visiting and auditioning a number of auditoria with electronic architecture around the world, a LARES (Lexicon Acoustic Reinforcement & Enhancement System) system was chosen. Some passive acoustic changes were also incorporated. The carpet was replaced with parquet — partly to extend high frequency reverberation, but mainly to appease people who thought carpet and good acoustics don't go together.

Absorptive treatment to the fly tower above the stage and the ceiling space above the auditorium reduced low frequency reverberation, giving more even reverberation times across the frequency spectrum. A modified orchestra pit rail was constructed and rear wall absorption was installed to reduce an echo problem.

Collaboration needed

LARES Associates do not provide 'turn key' installations, or (generally) even complete system designs. They manufacture and supply key components, such as the acoustic DSP processors, and provide design criteria such as loudspeaker placement recommendations. Essentially they work in partnership with acoustic consultants and specialist sound designers on each project.

The Festival Theatre system design was a collaboration between Mr Steve Barber (Principal, LARES Associates), Dr Peter Swift (Principal, Bassett Acoustics), and the author, who at the time was an employee at the theatre. E-mail was used extensively to ferry drawings back and forth between parties. Steve Barber at LARES in Boston, USA, worked from three-dimensional AutoCad drawings, photographs and a description of the space.

LARES Associates allow considerable freedom in the specification of the system peripheral equipment. The design team chose to implement the system using Peavey Media Matrix, which is a PC-based virtual sound system. The advantage of this approach is a great reduction in the amount of physical equipment that needs to be installed, and complete flexibility to redesign the system without a physical re-wire.

The system for the Festival Theatre is the largest and most sophisticated LARES system in the world to date, and includes five LARES acoustic processor DSP frames. It also has 172 delay lines, 121 mixers, 128 equalisers and 12 high pass filters, implemented in Media Matrix, which requires a computer fully loaded with eight DSP cards. This equipment occupies slightly more than one two-metre high equipment rack, much less than the several racks required if the system was implemented in discrete components.

Fig.1 shows the Media Matrix system monitor screen, whilst Fig.2 shows the input part of the electro-acoustic system. Note how each block can be opened in Windows and the controls accessed. All of the control settings can be saved as a 'Preset' and recalled at the click of a mouse button — or as in this case, by another computer (see below).

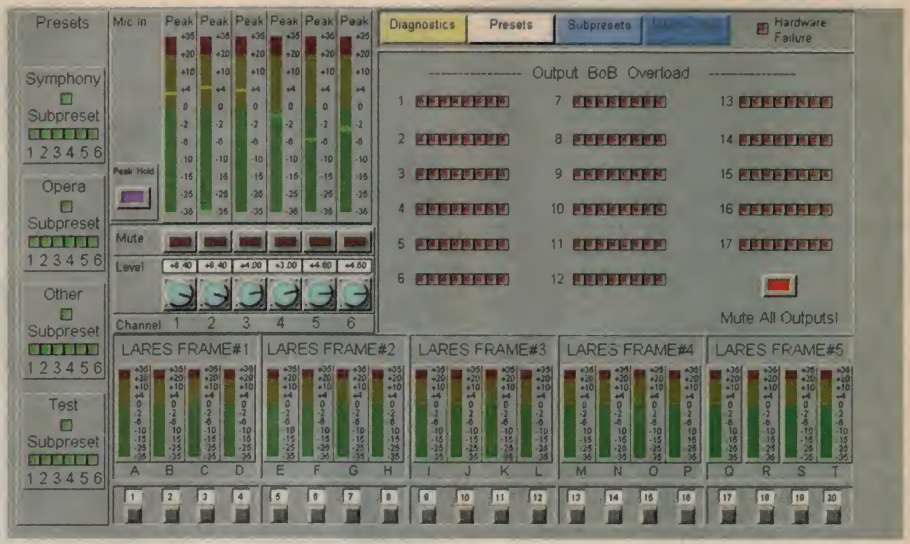


Fig.1: This is the operator's screen view from the Media Matrix computer, which runs under Windows 3.1. (Peavey do not consider Windows 95 or 98 stable enough!) Here all signal levels can be monitored.

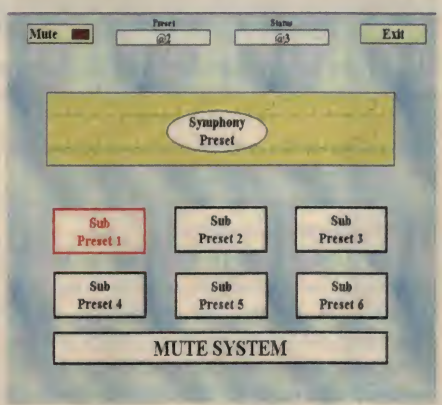


Fig.2 (left): This computer screen view shows the input circuits of the system in Media Matrix. By clicking on an icon, the control surfaces are opened, as illustrated. Values can be altered by dragging with a mouse, or by typing in a number. Circuits can be 'cut and pasted' just like other Windows software.

Project Credits

Project: Adelaide Festival Theatre Auditorium Redevelopment

Client: Adelaide Festival Centre Trust

Architect: Woods Bagot

Acoustic Consultants: Bassett Acoustics

Electro Acoustic Equipment: LARES Associates

Installation: Sontec (SA) Pty Ltd

Control system

A crucial element of the electro-acoustical system is a computer control system. A Crestron control system is used to adjust each piece of equipment according to the room setting chosen. Crestron is a dedicated control system that commands any other controllable device, whatever it is, via a dedicated Cresnet data network.

The heart of the Crestron controller is a touch-screen computer panel. On this panel the appropriate setting for the LARES system is selected for each performance. The panel incorporates password security to prevent tampering and limit control options. Because of the Crestron control system, no special skills are required to operate the LARES system.

To activate the LARES system a password is entered into the Crestron touch panel and a virtual button pressed to power up the system. The Crestron controller then turns on the power via a computer controlled circuit breaker panel, boots the Media Matrix computer and fires up the

power amplifiers. Each piece of equipment sends a confirmation signal back to the Crestron controller to confirm correct operation.

The next step is to select the appropriate setting for opera, orchestra, organ or choir, again by a virtual button on the Crestron touch screen. (See Fig.3, which shows the Crestron control screen for symphonic settings.) The Crestron then sends a command string to set the appropriate delay, level and equalisation parameters in Media Matrix and the acoustical simulation program in each LARES frame for that preset.

Once the preset is loaded the system is operational, and the Crestron computer and touch screen are used to monitor the performance of the amplifiers, circuit breakers and UPS (uninterruptable power supply). Fig.4 shows how all the parts of the system interconnect.

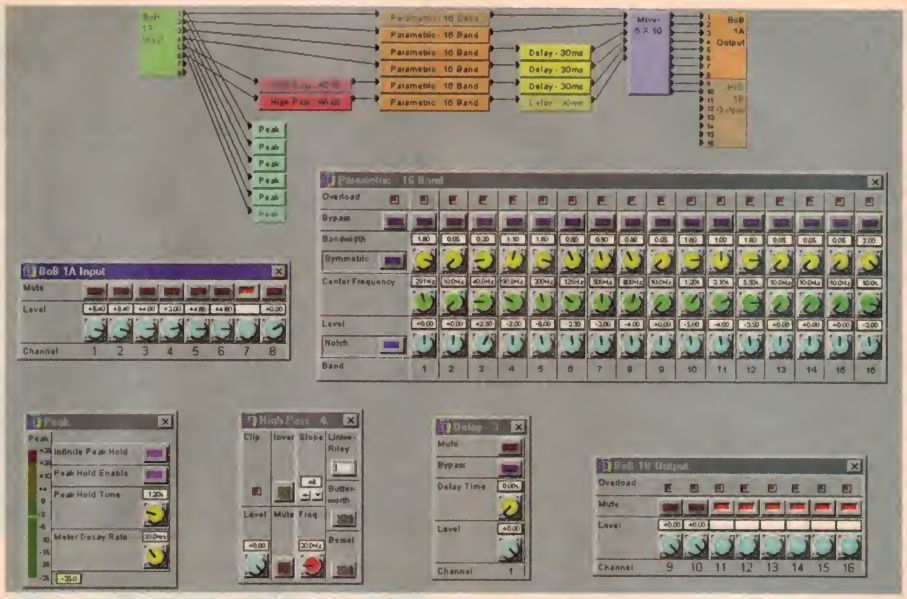


Fig.3: Here we can see the virtual buttons on the Crestron touch screen. Six sub-presets are provided, for a range of symphonic music settings from Baroque to Late Romantic.

Installation

The installed cost of the system amounted to A$850,000. The whole project from design to installation took just under five months from state government go-ahead (30 April 1998), to be completed in time for initial system tuning in September. Within this time frame, the loudspeaker prototypes were developed and evaluated prior to manufacture and installation.

A new Australian Monitor amplifier was developed, based on the well-known AM1200 workhorse with an on-board microprocessor and in-built Cresnet computer network interface for control and monitoring. The 51 amplifiers are conservatively rated at four x 200 watts each, for a total system power of in excess of 40,000 watts.

The team decided to pursue the manufacture of loudspeakers in Adelaide, since it has long been a centre of excellence — being the home town to some of the world's best hifi/audiophile manufacturers, namely Krix Loudspeakers, VAF Research, Sonique Sound Technology and Duntech Audio. These guys are not just high quality 'box stuffers'; they actually understand the acoustic wave behaviour of loudspeaker systems.

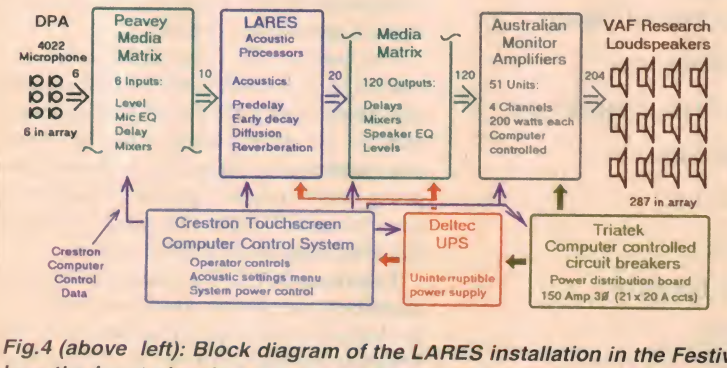
Both Krix and VAF designed and built prototype loudspeakers, which were air freighted to Boston for evaluation. Both were rated as superior to the LARES benchmark, and ultimately the VAF version was chosen for installation. See the first of these articles, in last month's *Electronics Australia* for more information about the development of the special VAF loudspeaker and Australian Monitor amplifier.

In the Festival Theatre system 287 loudspeakers were installed. The stage is covered from overhead by 24 loudspeakers mounted on counterweight fly bars, plus an additional eight for lateral energy mounted four a side at fly gallery level. Twenty-four loudspeakers are mounted around the proscenium, made up of six in a concealed column on each side and 12 across the top in two rows of six.

A further 80 loudspeakers are concealed in the ceiling proper, and 28 flushed into each of the auditorium side walls. You can see the holes being cut in the accompanying pictures. Thirty-seven loudspeakers are flushed into the underside of the second balcony and 42 into the underside of the first balcony. Sixteen loudspeakers are concealed in the fronts of the lower seating boxes to add additional lateral energy to the stalls. (See pictures)

In all, there were nearly 100 speaker penetrations in 200mm poured concrete wall or ceiling slabs, and 56 in 100mm concrete, all of which had to be airtight and sound proof. After taking five weeks to chip out 28 holes with circular saws and jackhammers, the contractor brought in a concrete cutting

Fig.5 (below right): Measured reverberation times in the Festival Theatre auditorium. 'Original Theatre' shows times measured before the acoustic treatments and LARES system was installed. 'System Off shows the effect of the passive treatments alone, which cost approximately $600,000. The other two lines show the range of variability now available at the push of a button.



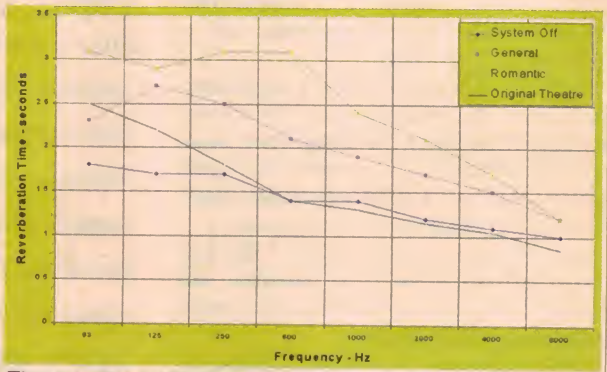


Fig.4 (above left): Block diagram of the LARES installation in the Festival Theatre. The LARES component is seen in dark blue. Note how the input signals are processed in Media Matrix before going to the LARES DSP's, and then back to Media Matrix for output processing. The number of circuits is indicated above each arrow.

chainsaw complete with diamond-encrusted chain. The next 28 holes took less than one week: now that's really 'cooking with gas'!

Each loudspeaker is individually connected to the racks of power amplifiers mounted with the LARES equipment in a room at the rear of the second balcony. This location was chosen to minimise the length of loudspeaker cabling, which still runs to nearly 20 kilometres. The installation dissipates enough waste energy to heat a couple of houses, necessitating two split-system air conditioners for the equipment room.

Loudspeaker equalisation is implemented by five-band parametric equalisers in Media Matrix. LARES engineers equalised individual loudspeaker frequency responses to a tolerance of +/-1dB from 60Hz to 12kHz, whilst the acoustic power level across the room at any seat from the system is easily within +/-0.5dB. Reverberation energy is not required above 12kHz because of normal air losses, which attenuate high frequencies.

Does it really work?

Fig.5 illustrates the variation in reverberation times that are achieved by two different symphonic settings. You can also see the changes in reverberation time brought about by the passive acoustic changes. Adding 700 square metres of 'fuzz' has reduced low frequency reverberation and removing the carpet has (very slightly) increased high frequency reverberation. The 'General' setting is for music from the 18th century classical period typified by Haydn and Mozart, whilst the 'Romantic' setting is for a music style typified by Beethoven and Tchaikovsky.

The most obvious outcome has been very strong positive acclaim by patrons, critics and performers. The improvement in sound is theatre wide, but in particular under the balconies at the rear.

When the LARES system is operating it is not obvious that it is doing anything or that anything is happening. Even when standing quite close to a loudspeaker, no sound is readily apparent. However for the audience, opera singers are louder and have great clarity. The orchestra is warmer and well blended. In concert mode there is a greater sense of envelopment. Sitting in the rear of the stalls or first balcony under the balcony overhang above, you can close your eyes and imagine that the low ceiling has gone and that you are in the middle of a great concert hall.

The listeners feel like they are in the same acoustic space as the performers because the microphones pick up ambient audience noise as well. Performers hear the auditorium in a way that supports their performance. Singers and orchestras are able to hear each other much more clearly, greatly assisting ensemble work.

People sense these changes, but do not attribute them to the electro acoustic enhancement. Most people, including music professionals, can only believe what the system is doing by having it disabled during use.

Installation of the VAF loudspeakers. If you look carefully, you can see some of the loudspeakers flushed into the side walls. The eight holes on the front of the lower seating boxes will also conceal loudspeakers.

A closeup of the boxes with one loudspeaker's cover removed. These loudspeakers used the cavity of the building structure as their enclosure, so as not to reduce 'leg room' in the boxes.

The following published reviews typify the success of this installation:

Generally the sound is a miracle, every harp glissando and thundering percussion glittering like electricity in the theatre's new acoustic — Noel Purdon reviewing The Ring operas in *RealTime*, February/March 1999.

Thankfully, the disagreeable old acoustic has at last been banished. In its place on this occasion there was considerably increased volume and resonance, coupled with freshness and even some edginess to the sound — Rodney Smith reviewing the first Mozart symphony concert, *The Advertiser*, 12 April 1999.

The future

Electronic architecture through electro-acoustic systems has given us the ability to create virtual acoustic spaces. To date, most electronic architecture systems have been retro-fitted to improve the acoustical performance of existing venues, with the bonus that electro-acoustic systems bring the potential for variable acoustics.

New auditoria designed from the ground up for the inclusion of electro-acoustic systems will benefit from relaxed constraints on some acoustical requirements difficult to achieve through architectural design.

In the past, composers were constrained by the performance spaces available to them and wrote compositions to suit those spaces. It is probable that contemporary composers will write works to be performed in a variable acoustic.

Other applications for electronic architecture include sports stadiums to enhance crowd noise, churches to boost congregational responses and rehearsal studios to let performers hear what it will sound like when they perform on stage. LARES systems have even been used to recreate concert hall acoustics for outdoor performances, such as Mozart concerts at the Vienna Festival and the opera *Turandot* at the Forbidden City in Beijing.

LARES, which is an offshoot of Lexicon (**www.lexicon.com**), the manufacturers of high-end home theatre and professional digital sound processors, have teamed up with Wenger Corporation, a manufacturer of accessories required for musical performance (such as seats, choral risers, music stands, etc.) to create a 'virtual room in a box'. These small prefabricated rooms are designed to isolate otherwise intrusive noises, and are equipped with microphones, processing, amplifiers and loudspeakers.

Used primarily in schools of music, they allow a student and instructor or an ensemble to walk into a room where the distractions of ambient noise disappears, select a virtual room or hall of their choice, and play their instrument in that space. The student or instructor can change the environment 'on the fly' to readily demonstrate the impact that acoustics has on how the musician plays the instrument.

It is easy to see this technology becoming available in the consumer marketplace in the not-too-distant future.

(John Matheson designs electro-acoustic systems for Bassett Acoustics. He can be contacted on (08) 8363 1000.) ❖

Industrial robots from fischertechnik

The idea of designing your own robot is an intriguing one; unfortunately the practicalities of actually building the thing are pretty discouraging. With a personal interest in robotics myself, I thought I'd take the easy way out and take a look at the Industry Robotics kit from Fischertechnik. Procon Technologies were kind enough to send me one for review, and as I found, they offer a fair amount of additional support.

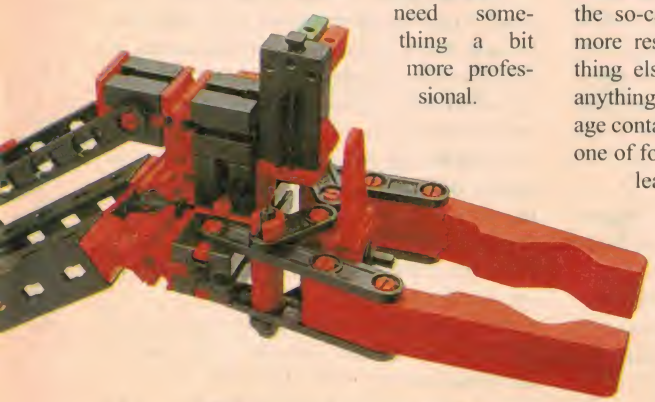
BY GRAHAM CATTLEY

If you've ever wanted to build your own robot, you had one of two options: get a machine shop and an engineering degree so that you can design and manufacture all the required parts, or build one with whatever tools and materials you have to hand.

Due to the usually limited resources available, the latter approach usually results in something less than satisfactory, assuming that it gets off the drawing board at all. If you've travelled down this path before, you'll have realised that a robot of almost any size requires a fair amount of precision engineering, and generally the smaller the robot, the more difficult this is to achieve.

So what's the answer? Buying a ready-made one is going to be expensive (no, *very* expensive) and besides, building the thing is half the fun. The alternative is to buy a robot kit, and this is where the market opens out.

A quick search on the web will return a number of small robot kits available, and these tend to be a bit of 'brains' on a circuit board with the odd motor or actuator converting it into a robot. These are good at demonstrating some of the general principles of robotics, but if you want your robot to actually do something useful you are going to need something a bit more professional.



If you go for the IR remote control module, you don't need to tie your creation to the PC. The chunky design makes the controller well suited to young (and not so young) hands.

Industry Robots

Just about everyone knows of Fischertechnik, the so-called 'Lego for grown-ups', which more resembles plastic Meccano then anything else. While you can build just about anything with it, their Industry Robots package contains all the bits you need to create any one of four robotic arms. Struts, locking pins, lead screws and gears are all here, along with the all-important motors, switches and control module. There are over 500 pieces in the kit, and with them you can construct some pretty sophisticated machines

While the robot is essentially PC-controlled, it does use a Temic 80C32 microprocessor in the control module to interface between the PC and the various motors and limit switches on the robot. The interface to the PC is made via a standard RS-232 serial link, and the control module is powered by a hefty plugpack, as it also supplies current to the motors.

Along with the control module and plugpack and some bags containing several hundred precision-molded Fischertechnik pieces (many of which have been designed specifically for the Industry Robots kit), comes a user's manual. Not just any user's manual, but one of the most clear and concise construction guides that I have ever seen.

Imagine, if you will, the need to explain (in six different languages) the design of a 400-piece robot arm, bearing in mind that the constructor may well be aged anywhere between 10 and 100. It is of course done with diagrams, and lots of them, too. Every stage of construction is covered, leaving nothing to chance. Every brick, rod, clip and cog is shown is remarkably clear detail, with no ambiguity or potential for error.

On top of this, Procon Technology also supply a ring binder containing construction notes for each of the four models, as well as descriptions of the various switches, motors and lights supplied in the kit. It also covers the basics of current flow, and explains the various ways to wire up the electrical components.

As well as getting the Industrial Robots kit, I decided to go the whole hog and get the IR control set as well. This is a separate matchbox-sized IR receiver module with matching remote control. With it, you can manually control up to three motors without having to connect your latest creation up to the PC. The remote is quite chunky, and well suited to the application with 11 sensibly

You get quite a lot in the kit, including manuals, CD-ROMs, and even the plug pack (not shown). Of course you also get around 500 small pieces of plastic, which are arranged here in the form of the kink-arm robot.

labeled and positive-acting buttons. It also has a bright red LED that indicates when the unit is transmitting.

Building the robot

Faced with 500 small pieces of plastic, a hank of hookup wire, two CD-ROMS (plus a floppy disk), the IR control module with its remote, a serial cable, three instruction books and a plug-pack, I was feeling a little overwhelmed...

Thankfully, the construction notes from Procon were well thought out, and explained what you should do first, and where to start in building the models. Once I had skimmed through the 25 or so pages, I was in a much better position to tackle the task of building a robot. Always a glutton for punishment, I jumped in the deep end and went for the forth and most complex model, the 'kink-arm' robot you can see in the photos. It offers three degrees of freedom (plus grippers) and operates within a 35cm radius.

As I mentioned earlier, the Fischertechnik construction manual was superb, and after around four hours I had finished the major mechanical construction, leaving only the wiring to be done. The Fischertechnik manual suggested a rather uncharacteristically untidy arrangement, with the wiring looms hanging free around the arm, but the Procon construction notes suggested the much neater method shown with everything routed through the centre of the main turntable. With just about all the hardware finished, all that remained was to connect the arm to the PC with the supplied serial cable, and then tackle the software side of things.

The abundance of software supplied with the kit had me a bit worried at first, and so I inserted the Fischertechnik CD into the drive and ran their setup program.

Had I read the Procon manual properly, I'd have found that it explained everything, with the driver programs for each of the four robots and diagnostic software supplied on the floppy. As I had already installed from the CD, I decided to press on, and selected the appropriate robot from the new program group in the Win95 start menu.

Success! Well, sort of. It turned out that I had a couple of the motors wired up in reverse, but once that was fixed, I could steer the arm practically anywhere by simply clicking the program's on-screen controls with the mouse. To be honest, I couldn't wipe the grin of my face as I maneuvered the grippers to pick up the (thoughtfully supplied) canisters and stack them on a couple of books.

Programming

If you are looking for a way of automatically controlling your robot arm, the software supplied by Procon is a good start. They supply the source code (in QBASIC) for the main controlling programs, and after a bit of reading there is no reason why you shouldn't be able to write your own control routines. If you aren't up to writing programs in BASIC, you can use the 'macro' style recording function built in to the control software from the Fischertechnik CD. All you have to do is manually position the arm using the on-screen con-

trols, and click on 'Save position'. The arm's current position is stored in a list, and you can then manually move the arm to the next position, store it, and so on.

Once you have completed the maneuver, you can hit 'Replay' and the arm will automatically go through the recorded motions, and if satisfactory, you can save the program to disk. While simple and straightforward, this system is extremely effective, and after half an hour or so I had the arm repeatedly stacking and unstacking the two canisters.

I left it running for around two hours, and there was surprisingly little creep in the canister's position. This highlighted the fact that despite being made out of hundreds of discrete plastic parts, the arm was very precise in its movements - it would replace the canister to within a fraction of a millimeter of its original position every time.

For those interested in the other extreme of programming complexity, there's Lucky Logic for Windows (LLWIN). This is a full graphically oriented programming language where programs are 'written' in a flow chart style using ready-made function blocks to represent the various programmed operations. Variables, conditional branching, timers and I/O are all supported, and you simply link together the blocks you need to create your program. It's all pretty straightforward, and if you've done any programming in the past, it shouldn't take you long to get the hang of it.

Fischertechnik Industry Robots kit

A 500-piece kit that can make any one of for robotic arms

Good points: *Exceptional manuals, High quality and professional design. Lots of programming options too.*
Bad points: *You'll need patience...*
OP: *$695. a parallel port version without the LLWIN software is available for $495, and other combinations are available. The IR control set is $189, with all prices including sales tax.*
Available: *Procon Technology, P.O. Box 655 Mt. Waverly, Vic. 3149; Phone: (03) 9830 6288, fax: (03) 9830 6481; Email procon@tpgi.com.au*

Good design

Someone asked me what the intended age group was with this robots kit, and it caused me to stop and think: all 500 pieces of the kit are well designed, and practically indestructible, so there'd be no danger in letting a five or six year-old have a go - short of being able to find all the bits again afterwards... However, good as the instruction manuals are, the assembly of a robot will require hours of concentrated effort, and an attention to detail.

I'd therefore suggest that the kit would be more suited to someone able to put in the time and patience into the construction of the robots, and who would then be prepared to make the most of it by following through with the software and programming side.

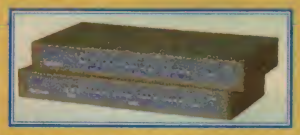
These robots aren't toys, and could well sell as built-up units in their own right. A lot of engineering has gone into the design of these kits, particularly when you realise that there's only a handful of unused bits left over after building any one of them.

Any complaints? Well, no, actually. Any slight kinks in the building of each robot is covered in the manual supplied by Procon, so the only problem you'll face is the need to pull your creation apart in order to build the next one... I'll face a much larger one in that I have to return the kit to Procon after finishing this review. Oh well.❖

Web links
[http://www1.tpgi.com.au/users/p8king]
[http://www/fischertechnik.de]

MicroGram Computers

Internet Router



The Internet Router is a high performance all-in-one network communication device. It provides a local area network with Internet access, the convenience of remote access, and the power to combine your office networks together using LAN-to-LAN routing (IP routing). Two models are available with two or four WAN ports that can support both analog modems and ISDN terminal adapters. The Internet Router is simple, intuitive, and designed for the SOHO user.

Cat. 10110 **Internet Router 5 LAN 2 WAN** $749
Cat. 10111 **Internet Router 1 LAN 4 WAN** $999

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Need to link a 10Base-T network to a 100Base-T network? Try this compact 2-port switch with two 10/100 UTP connections.

Cat. 11319 **10BaseT to 100BaseT Switch** $238

10/100Base-T to 10Base-2 Switch

Allows 10Base-2, 10Base-T & 100Base-T networks to be connected. This switch provides two UTP 10/100 auto negotiation ports, and an AUI/BNC uplink port.

Cat. 11320 **10/100BaseT to 10Base2 Switch** $349

Converter Ethernet 10Base-T to 10Base-2

Allows an existing 10Base-2 network to connect to a 10Base-T network. This converter provides 1 x RJ45 shielded connector & 1 x BNC connector.

Cat. 11234 **Converter 10BaseT to 10Base2** $129

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Avoid downtime delays when your hard drive fails! This unit enables the user to replace the hard disk while the PC is operating and it automatically resynchronizes itself to full operation. The RAID unit fits into two continuous 5.25" bays and includes a controller and two removable frames. The array accepts two EIDE, Ultra DMA 66/33 or PIO 4 hard drives. The controller provides RAID Level 1 disk mirroring. It can also be used as an on-line hard drive copier.

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Cat. 8896 **Pressure Sensitive Pen Tablet** $169

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A handy compact sized 88 key keyboard with integral "mouse" pointing button. It is a cordless design using infra red technology. The receiver is fitted with a PS/2 Mini DIN connector.

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These Touch panel based Point-of-Sales products provide a total solution for the retail & hospitality market, restaurants, supermarkets, petrol stations, banks, etc. Start with a compact all-in-one terminal and add the peripherals you need to customize your requirements. The basic system consists of a Pentium motherboard with 133MHz MMX CPU, 16MB RAM, 4 serial ports, 2 parallel ports, 2 USB ports, VGA port, cash drawer port, 1 free PCI slot, KB/mouse. A 10Base-T Ethernet port is included as well as a slim type 24x speed CD-ROM. Touch panel technology comes with the 12.1" TFT colour LCD with 800 x 600 resolution. The swivel base allows the LCD screen to be rotated.

Cat. 8755 **POS Touch System with LCD & Swivel Base** $4,900

Optional add-ons include a magnetic card reader, a magnetic I-Button reader with 5 operator keys for security access, an external FDD kit, Customer Display and cash drawers.

Cat. 8756 **POS Touch System MCR Track 2** $299
Cat. 8757 **Magnetic I-Button Reader + 5 keys** $190
Cat. 8758 **External FDD Kit** $219
Cat. 8728 **POS Customer Display, Serial Connection** $369

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This card carries the NSTL "Compatibility Test" seal.

Even Pentium motherboards are not immune to the Year 2000 bug! This Year 2000 BIOS Card solves the problem of progression from 1999 to 2000 as well as 21st century leap years. It is also double-buffered to take care of the Crouch-Echlin effect. **"It worked well in fact, and the machine passed all the tests we threw at it."** Mar 99 Electronics Australia magazine.

Cat. 3359 **Year 2000 BIOS Card** $129

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1 x Siren horn:	$19.95
1 x Internal siren:	$19.95
4 x Deterrent stickers:	$8.00
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30mt. roll 2 core cable:	$9.95
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2 x Reed/magnets:	$9.00
1 x Strobe:	$21.95
1 x AB siren cover:	$19.95
1 x Siren horn:	$19.95
1 x Internal siren:	$19.95
4 x Deterrent stickers:	$8.00
200mt. 6 core alarm cable:	$210.00
30mt. roll 2 core cable:	$9.95
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NEW

Refer Electronics Australia Sept. 99.
This new Isobarik subwoofer kit uses 2 x 12" polycone woofers and a 65w RMS prebuild amplifier module. The cabinet is supplied partly assembled, and in a raw state which can, when finished be painted, carpeted, or left raw if its hidden away behind the sofa.

Quote from Electronics Australia.
"Overall then, we'd have to say that from what we've heard of commercial subwoofers costing two or three times the price of the Jaycar Isobarik, it represents very good value indeed. If you're prepared to tackle this type of kit loudspeaker, where you only need to bolt components in place and finish the box to your personal taste, then this must be one of the most cost-effective ways to own your own high-performance powered subwoofer"

SUBWOOFERS (2 X CW-2130)	$193.90
65W AMPLIFIER MODULE (AA-0502)	$192.00
CABINET KIT (CS-2536)	$219.00
Buy all Together for only $569	$604.90
For 150W module add $126	Save $35.90

13.8V DC Regulated Heavy Duty Power Supplies

These rugged power units are ideally suited for powering CB radios, communications receivers, garden lighting and other devices.

5A	Cat. MP-3072	$129
10A	Cat. MP-3074	$169
15A	Cat. MP-3075	$199

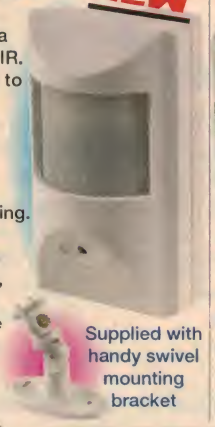
NEW AVAILABLE EARLY SEPTEMBER

IT LOOKS LIKE A PIR, BUT ITS NOT!

NEW

This brand new B&W CCD camera looks just like a PIR. What a great way to Disguise the camera! Includes special CCD pinhole board camera module, audio, PIR mounting. Bracket and is supplied with line sockets for video, power and audio connections. Size 120(h)x 70(w)mm. Cat. QC-3479

$149.50



Supplied with handy swivel mounting bracket

BATTERY MADNESS

Below Half Price

A customer cancelled an order, and we are overstocked. Your gain, stock up while you can at these crazy prices. Batteries are Vinnic brand, Heavy Duty with no mercury.

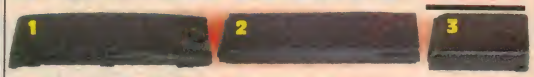
2xC HEAVY DUTY NOW $1.20 PKT
WAS $2.70 SAVE $1.50 Cat SB-2342

4xAA HEAVY DUTY NOW $1.40 PKT
WAS $3.20 SAVE $1.80 Cat SB-2341

Jaycar will match or better the price of any product our competitors sell, provided the goods are in stock, and of the same quality. Sale prices included

New Mobile Batteries

NEW



1) SB-2557	Nokia 5110 600mAh Slim	$39.95
2) SB-2575	Ericson 788 600mAh Ultra Slim	$39.95
3) SB-2584	NEC Mercury 600mAh	$39.95

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OVERNIGHT DELIVERY

4 SECTOR HOME ALARM SYSTEM

This home security system comes complete with everything you will need. It has a PIR detector, three magnetic switches for doors and windows, an external siren, AC power supply plus hardware. Extra PIR and magnetic switches can be added if required. See 1999 catalogue page 84 for full details. Cat. LA-5410

Was $129.95
Save $29.95
September $100

Car Alarm Back Up Battery Siren

Small sized siren. It has a rechargeable back up battery pack mounted inside the unit. Cat LA-8910

Was $49.95
Save $10
September $39.95

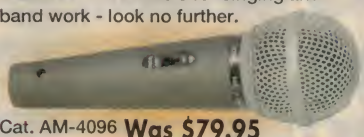
Computer Microphone Headset

Lightweight headset / microphone designed for Multimedia use. Cat. AA-2028

Was $14.95
Sept. $9
Save $5.95

Unidirectional Balanced Professional Vocal Dynamic Microphone

If you are looking for a top quality balanced mic suitable for singing and band work - look no further.



Cat. AM-4096 Was $79.95
Sept. $59.95 Save $20

Mobile Baby Monitor Sale

Baby phone is a baby monitor system which will alert parents if the baby is crying.....
The transmitter unit sits in the baby's room, and plugs into the mains for power. The transmit range is about 30- 50 metres. The receiver can be clipped on to a belt or in a pocket when you're out in the garden, or moving around the house.
Cat. AI-5540 Was $59.95
Sept. $39.95 Save $20

60 In One Electronic Project Lab

Cat. KJ-7025
Was $46.95
Save $7
Sept. $39.95

Alarm Strobes Mini Size

This mini strobe is weatherproof and rustproof. It uses a xenon tube and is designed for long life.
Blue Lens Cat. LA-5302 **Red Lens** Cat. LA-5303
Was $21.95ea Sept $16.95ea Save $5ea

Bargain Bags

NEW

We have just finished a new run of our famous Bargain bags. Each bag contains up to 2kg of electronic goodies - "Junk" if you like!
Cat. XB-9000

$17.95

Bargain Boxes

NEW

These are basically a bargain bag, plus even more goodies, bigger bulkier items.
Cat. XB-9001

$29.95

Due to the enormous weight, p&p is normal rates, plus $5 extra for the bag and $8 extra for the box

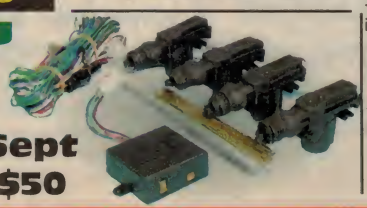
BUY 5 OF A PRODUCT WORTH $100 OR MORE LESS 10%

Car Door Locking

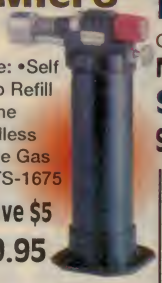
4 Door Car Power Door Lock Kit

Specifically designed for automobile (12V) application but are equally suitable for virtually any applications where remote control actuators/alarms are required.

If you own a 4 door car and want the convenience of power door locking, this is the kit for you.
Cat. LR-8830
Was $59
Save $9
Sept $50



DURATECH Piezo Micro Torch



Features include: •Self igniting •Easy to Refill •Adjustable flame •Portable •Cordless •1300°C •Butane Gas Powered. Cat. TS-1675

Was $44.95 Save $5
Sept. $39.95

Pen Type Thermo Hygrometer

Ideal for the top pocket! Temperature range -20° to +50°C, humidity 0% to 100%. Includes data hold. See 99 Cat. page 232 for full details. Cat. QM-1595

Was $119
Save $30 September $89

CD STEREO HEADPHONES

Grab some new headphones & save!
NORMALLY $32.95
September $20Pr
Save $12.95 Cat. AA-2010

Make Your Own Clock

Why buy a wall clock when you can now make your own unique clock.
Cat. XC-0100

Was $10.95
Sept. $8.95
Save $2

Anti-Static Floor Mat

This anti-static floor mat is made from conductive PVC sheet combined with high density PVC foam.
Cat. TH-1786

Was $149 Sept $119 Save $30

Wireless Audio and Video Transmitter / Receiver

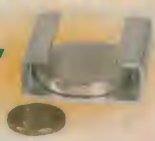
WATCH CABLE TV ALL OVER THE HOUSE!
The transmitter can transmit the audio/video signals from a VCR, TV set, LD, Sat receiver.... - to the distant receiver, which is connected to another TV or VCR.
Cat. AR-1800 **Use a wireless CCD camera setup!**

Was $299.50 Save $30
Sept. $269.50

Wireless Indoor/Outdoor Thermometer

This fantastic product will support up to three remote sensors which can be placed anywhere you like and transmit to the main unit which is usually mounted in the house. The main unit features a high/low alarm for every sensor, min/max reading with a temperature range of -5°C to 50°C.
Cat. QM-7220
Was $99 Save $30
September $69

Rare Earth Neo "Scary Magnets"



These magnets are so strong, they are scary - especially when in pairs!!
LARGE 35mm dia x 5mm ea Cat. LM-1620
Was $22.95 Sept. $15 Save $7.95

Extremely Large Digital Clock with Humidity, Temperature & Calendar

Was $99.95
Sept. $79.95
Save $20

Ideal for office, factories, homes, wine cellars etc.
Cat. XC-0232

Terminal Strip

Nylon terminal strips are suitable for many applications. Sold in standard length of 12 way - they can always be cut down to a smaller size if required.

Terminal Block

30 Amp cable entry dia: 5.1mm
Length 152mm Cat. HM-3198
Was $2.25ea
Sept. $2ea or 10 for $12

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LOWER PRICES ON CCD CAMERAS

Board Camera with Audio Cat. QC-3462
Was $119 **Sept. $99** Save $20

Pinhole with Audio Cat. QC-3463
Was $119 **Sept. $99** Save $20

Metal Case with Audio Cat. QC-3474
Was $139 **Sept. $119** Save $20

Pinhole in Case with Audio Cat. QC-3475
Was $139 **Sept. $119** Save $20

Colour with Audio Cat. QC-3483
Was $249 **Sept. $229** Save $20

B & W Dome Cat. QC-3472
Was $129 **Sept. $119** Save $10

In Case with Illumination Cat. QC-3466
Was $139 **Sept. $119** Save $20

PIR CCD Camera Cat. QC-3478
Was $199 **Sept. $159** Save $40

JC-50 10" 3 Way Speaker Kit

See 99 Cat. page 51 for full details.

SPEAKER KIT - Pair Consists of: •2 x 10" Re/Sponse polycone woofers •2 x Re/Sponse dome midranges •2 x Vifa D19 dome tweeters •2 x pre-built crossovers with rear terminals •Ports •Screws •Cable •Lining material Cat. CS-2550

CABINETS - Pair Consists of two pre-built cabinets constructed of high quality MDF and finished in black-grey oak. Size 295(W) x 300(D) x 845(H)mm. Speaker grille cloth pre-mounted on removeable frames. Cat. CS-2552

Special Freight Deal: Anywhere in Australia by Road Freight for full kit with cabinets-Only $30 plus insurance $9.

Cat. CS-2550 SPEAKER KIT
Was $579Pr
Sept. Only $479
Save $100Pr

Cat. CS-2552 CABINET KIT
Was $319Pr
Sept. Only $279
Save $40Pr

BUY TOGETHER $739 AND SAVE $130

Design Speaker Boxes Fast & Accurately with BassBox Pro

See 99 Cat. P47 for details. Cat. XC-5020
Was $299 **Sept. $249** Save $50

DURATECH Soldering Station

See 99 Cat. page 128 for details. Cat. TS-1380

$189

Buy in September Receive FREE $31.30 worth

200g Roll Solder NS3005 $6.50
3 Rolls Desolderwick NS3020 $9.85
Desolderpump TH-1862 $14.95

Wireless CCD Camera System

Cat. QC-3448
Was $599 **Now $529** Save $70
EXTRA CAMERAS Sept $349 ea Save $50 ea
Cat. QC-3445
System accepts up to 4 cameras

SEE CAT P218 FOR DETAILS

Jaycar 40W & 80W 240V High Power Soldering Irons

40 Watt Model Cat. TS-1475
Was $27.95 Save $10
September $17.95

80 Watt Model Cat. TS-1485
Was $32.95 Save $10 **September $22.95**

AEI 6 Sector Professional Alarm Panel + Keypad NEW

Brand new for 1999. This new panel includes all the latest features required for current security measures. See 99 Cat P86 for details.
Cat. LA-5360
INCLUDES KEYPAD **$239.50**
Extra Keypads Cat. LA-5362 $89.50

AEI 6 Sector Pro Alarm Kit

SAVE $94

NEW

Do it yourself, and save! Kit includes the following:

AEI 6 sector panel with keypad	$239.50
3 x Pulse analogue PIR's	$104.85
1 x Mains power supply	$21.50
1 x 7Ah back up battery	$39.95
1 x Strobe warning light	$21.95
1 x Siren cover/ tamper switch	$19.95
1 x Siren horn	$19.95
1 x Internal siren	$19.95
3 x Reed/magnet switches	$13.50
100 metres 4 core alarm cable	$58.00
2 x Alarm stickers	$4.00
TOTAL	$563.10

Cat. LA-5365 **PAY ONLY $469.00**

75 Ohm Air Spaced TV Coax Bargain

30mt Roll Cat WB-2007
Was $32.95 Save $7
September $25.95

100mt Roll Cat WB-2006
Was $100 Save $35
September $65

Per Metre Cat WB-2006
Was $1.45 Save $0.45
September $1.00

NASHUA GAFFER TAPE

40 Mtr rolls. 50mm Wide.
Norm. $22.50
Sept. $17.50 Roll
Black - Cat NM-2812
Silver - Cat NM-2814
Save $5

DIGITECH Mini DMM

- 3.5 Digit
- Small Size
- Accurate
- With Case
- Diode Test

Cat QM1410
Was $16.95
Save $4.95
September $12

NEW JAYCAR KIT

SUB BASS PROCESSOR KIT

Ref: Electronics Aust 9/99
Correct & enhance low frequencies on your subwoofer style speaker system. Features include equalise "bypassable" 20Hz high pass filter 40-200Hz low pass filter, +/-12dB gain & dual phase output for bridging a stereo amplifier. Short form kit includes PCB, +/-15V regulators & all electronic components. Cat KA-1814

$24.95

DIGITECH Low Ohms DMM

•3.5 Digit (17mm) •Measure very low resistance •4 - wire Ω measurement system •0.2Ω full scale •600V AC/DC •Transistor test •Square wave generator •Auto zero •Auto polarity •Holsterincluded. Cat. QM-1470

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Now Only $69.95

Car Alarm Remote Key FOB

Is your car alarm remote not working too well? Problem solved! This key fob transmitter will learn the code of your transmitter. It can actually learn up to 4 different frequencies, so it can be programmed for the car alarm, the garage door, home alarm etc, etc. Supplied with full instructions. Cat. LA-8990

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Jaycar Blue CDR's

Supplied in jewel case.
Cat. XC-4712

1 DISK	$2.85
10 DISKS	$24.50
100 DISKS	$235.00

Philips Blue CDR's

Supplied in jewel case.
Cat. XC-4711

1 DISK	$3.40
10 DISKS	$29.50
100 DISKS	$270

Jaycar Blue CDR's

In bulk pack of 10. No case.
Cat. XC-4714

1 PACK - 10 DISKS	$22.50
10 PACKS - 100 DISKS	$210.00

Ricoh Gold CDR's

Supplied in jewel case.
Cat. XC-4710

1 DISK	$3.95
10 DISKS	$33.50
100 DISKS	$320.00

Rewritable CD

74min. 650mb
Cat. XC-4720
was $9.95
Now $7.95
10+ $6.95

SONY Computer Disks

LOWER PRICES

3.5" DSHD IBM Formatted
XC-4753 PKT 10
Were $14.95 Save $4
Now $10.95

VCR Alignment Tool Kit

Kit includes: •3 reversable screwdrivers (see our TD2033) •7 x assorted head and guide aligners •VCR head puller •Retaining remover •Spring hook •8 pc hex key set with micor phillips head driver •Vinyl carry zip-up carry bag with strap (240x140x35mm)
Cat. TD-2050

Was $79.95
Sept $49.95
Save $30

REMOTE CONTROL SWITCHES

See 99 Cat P79 for details.

Latching Unit:

This unit has both Normally Open and Normally Closed contacts. Ideal for switching on/off home burglar alarm, house appliances etc.
•2 transmitters and 1 receiver supplied.
Cat. LR-8820 was $89.95 save $20
September $69.95

Momentary Unit:

This unit has 2 relays in the receiver. Both relays can be wired in either Normally Open or Normally Closed contacts wiring configurations. Ideal for car central locking, car alarms, switch logic circuits, remote paging using 2 different buzzers etc etc.
Cat. LR-8822 was $109.95 save $20
September $89.95

BUY 10 LESS 10%

Jaycar Books

Loudspeaker Design Cookbook

was $69.95
Sept $59.95
Save $10
Cat. BA-1400

Bullock on Boxes

was $24.95
Sept $19.95
Save $5
Cat. BA-1408

Electrostatic Loud Speaker Design Cookbook

was $69.95
Sept. $59.95
Save $10
Cat. BA-1404

Audio Amateur Power Amp Projects

was $45.00
Sept. $35
Save $10
Cat. BA-1418

Electrostatic Loud Speaker Design & Construction

was $39.95
Sept. $29.95
Save $10
Cat. BA-1406

Testing Loud Speakers by Joseph D'Appolito

was $69.95
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Cat. BA-1420

SHORT CIRCUITS

IDEAL FOR KIDS! *Used In Schools

Short Circuits assumes they know nothing about electronics. The book shows you what electronic components look like and how they work. There are 21 projects to build and all the components are supplied to build all the projects. There is no soldering required and all components are mounted on a baseboard with springs. Some projects are: •Short circuit tester •Police siren •Sound effects •Light chaser •Solar powered radio •Amplfier •Buzzboard & more.

SHORT CIRCUITS BOOK & PROJECT KIT

Cat. KJ-8502 $29.95

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9V DC 850mA Terminates to 1.75mm ID DC plug. Cat. MP-3009	$9.95
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10V DC 850mA Terminates to 1.75mm ID IDC plug. Cat. MP-3004	$9.95
10V DC 1200mA Terminates to 2.1mm DC plug. Cat. MP-3005	$11.95

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Now with FAN

Make your IDE hard disk drive transportable to any computer with a frame / cradle installed. The cradle is easily installed in a standard drive bay, with the hard disk drive mounted inside the removable frame. A key lock is provided. See 99 Cat. pg. 190 for full details.
IDE KIT Cat. XC-4670

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Jaycar's ISOBARIK Subwoofer

Jaycar electronics have recently released a compact but potent self-powered subwoofer that uses two 300mm bass driver in an 'Isobarik' configuration, and features a low-end response down to around 30Hz. As this configuration puts it in the same arena as some pretty impressive — but much more expensive — commercial subwoofers, we were more than keen to check it out.

BY ROB EVANS

With the home theatre market triggering quite boom in the sales of subwoofer speaker systems at the moment, loudspeaker manufacturers have understandably risen to the occasion by producing a vast range of dedicated low-frequency speakers for eager customers. Physically, these range from innocuous black boxes right through to artist-inspired show pieces that scare pets and small children, and in sizes to match just about any main speaker system.

Perhaps ironically though, it's these physical aspects of subwoofer design that often present the biggest challenge to designers, since with the exception of those with a radical shape, people want subwoofers to do their job in an inconspicuous way — heard but not seen, you might say. This in turn means that above all else, a subwoofer must be as *small* as possible, yet offer a performance level that will effortlessly complement the rest of the speaker system.

It's indeed a tall order. The basic and largely unavoidable physics of loudspeaker design dictate that you need to move lots of air to generate very low frequencies at reasonable power levels, and the only practical way to do this is with a large diameter driver in a large box. Bandpass style cabinets, tuned tubes, folded horns and a raft of other clever enclosure designs all offer their own advantages of course, but they too can't escape these basic principles.

The designers of the Jaycar Isobarik subwoofer, Occasion Audio, seem to have done a commendable job of *bending* the rules however, by creating a relatively compact subwoofer with a nominal power rating of 100 watts and a low-end response that extends right down to 30Hz. You would normally expect this sort of performance from a quite larger enclosure, yet the Jaycar Isobarik delivers the goods from just a neat 480mm cube.

It's a powered subwoofer, and in its standard format it includes a 65 watt amplifier/crossover module, with the option of moving up to a 150 watt model. The ready-to-roll electronics makes the unit easy to integrate into an existing hifi or home theatre setup, since extra amplifiers and large amounts of interwiring aren't needed. In fact most subwoofers are self-powered now, so this also places the Isobarik in a strong position amongst its competitors.

Being essentially a kit speaker, the Jaycar Isobarik is very competitive from a price point of view, too, and Jaycar have been able to offer the complete system for $569. This includes the drivers, the 65W amplifier/crossover module and the enclosure in a 'raw' unfinished form — see our shot of the raw cabinet. For more details on the cost of the individual parts of the kit, check out Jaycar's 1999 catalogue.

There's clearly a great deal of interest in add-on subwoofers at the moment, and

Jaycar seems to be on a winner here in terms of price, performance and size. By using appropriate drivers in an Isobarik configuration, the designer has extracted a level of performance that can't fail to impress.

Iso-what?

The Isobarik or compound speaker arrangement was first described by Olson way back in the 1950s, and simply involves coupling two woofers together to perform the one job. By mounting the two drivers in close proximity with a small sealed chamber between the two, the constant air pressure (hence the 'isobar' part of the name) between the two driver cones forces them to act as one. This assumes that they are also *electrically* connected as one, which in practice just means wiring the two in parallel.

So why go to all this trouble with two drivers, just to effectively end up with one? The answer lies in the perpetual problem of loudspeaker cabinet size, where we all want deep extended bass, but not at the expense of huge speaker boxes dominating our living area.

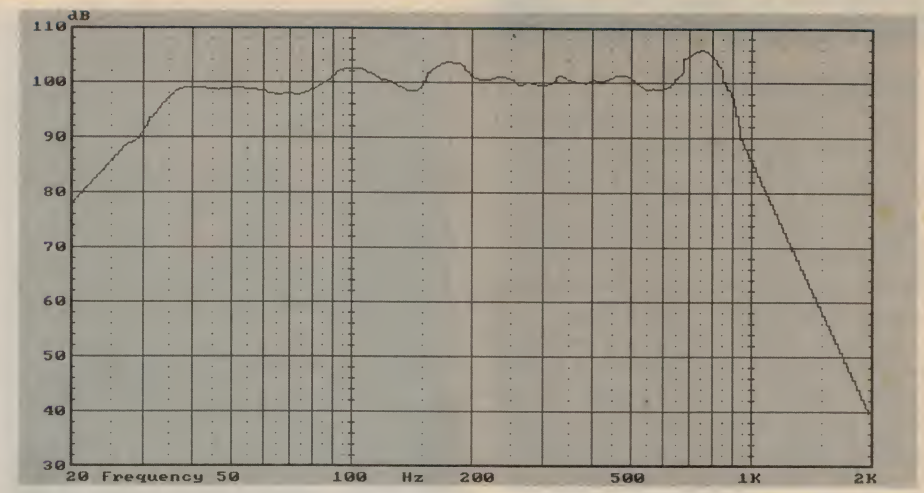
The trick here is that using two identical drivers in an Isobarik arrangement 'creates' one driver with *half* the 'equivalent compliance volume' (Vas) of each. As the Vas figure has a direct relationship to the enclosure size needed for a given low-end response, the Isobaric setup will offer the same response as with one driver, but in *half* of the original box volume.

This is quite a significant advantage when you consider the normal (and unfortunate) relationship between a driver's size and its Vas figure, which for subwoofer applications in particular, tends to lock you into a large driver in a large box. A small driver will have a much lower Vas of course, but the resulting subwoofer will suffer from the small driver's low power handling and modest low-end response.

It also goes without saying that there are no free lunches in the area of loudspeaker design, and with the Isobarik setup the tradeoff is mainly the cost of the additional driver. Note that the halved Vas is *not* associated with an increase in power handing or sensitivity, as you might expect from using two drivers in the one cabinet. Also, the system impedance will be halved in this setup, since the drivers are wired in parallel.

Jaycar's Isobarik

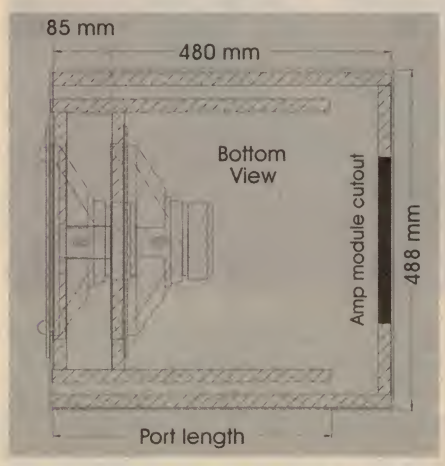
As you can see from the photographs and diagrams of Jaycar's enclosure, the designer has used a quite simple but clever arrangement to mount the two 300mm drivers in a compound format, by fitting an additional speaker-mounting baffle *inside* the box. While some compound designs have the drivers mounted face-to-face on one baffle, with a driver's rear-end pointing at the outside world (arguably impolite, but certainly unattractive), the Jaycar design approach results in a neat, business-like enclosure which should easily pass the feared domestic aesthetics test (DAT).



The Isobarik's natural output response when driven by a full-range amplifier, without a low-pass (subwoofer) filter rolling off the highs. It's quite flat down to a -3dB point of 32Hz, and any deviations at the upper end aren't a factor in the final setup, where a LP filter is used.

Internally, the 85mm gap between the baffles acts as the sealed coupling chamber for the two driver cones, and the two inner side panels form the enclosure tuning vents while adding strength to the whole structure. Just for the record, the enclosure has an internal volume of 65 litres, the vents are tuned to around 30Hz, and the response extends to a lower 3dB point of 32Hz.

The final frequency response of the enclosure/driver combination is shown by the measured response plot in Fig.1. As you can see, the result is commendably flat over the area of interest, while the lower rolloff region (below around 35Hz) is smooth and gradual. Note that a normal low-pass (subwoofer) filter was not used during that test, so the final powered subwoofer would exhibit an upper response that progressively falls beyond the filter's cutoff frequency (for example, 150Hz).



The two 300mm polycone drivers are coupled by a small sealed enclosure, which has enough depth (85mm) to prevent the rear cone from fouling the front magnet. The rest of the cabinet forms a fairly conventional reflex enclosure with dual slot-type vents.

All in all, it's an impressive response from a surprisingly small box, and demonstrates both the designer's skills and the success of the Isobarik approach. While many high-end subwoofer manufacturers would have us believe that you need exotic European-sourced drivers in a complex enclosure to achieve this sort of result, Jaycar's compact 100 watt-rated Isobarik enclosure evidently proves otherwise.

Self-powered

The Jaycar Isobarik is powered by a 65 watt active subwoofer module, which simply bolts into the back of the subwoofer enclosure via a matching cutout. This is a very convenient way to turn a subwoofer enclosure into a ready-to-go *powered* subwoofer in one step, and the module could be used in a range of other subwoofer designs. It installs easily with several mounting screws by the way, and making the electrical connections is similarly straightforward.

Being designed exclusively for subwoofer use, the power module is equipped with a practical array of features including a variable-frequency crossover, both speaker- and line-level inputs, a volume control and phase reversal switch, plus an automatic (signal-driven) powerup feature. When installed in the subwoofer, all you need is a signal source and a 240VAC outlet, and you're ready to go.

Jaycar also offer a 150W active subwoofer module for an additional (kit) cost of $126, for those that need more grunt than the standard 65W module has to offer. This more capable module features a large low-profile heatsink array, and offers additional functions such as power and thermal limiting, plus a more elaborate user-control setup.

Using the Isobarik

When it came to some good old-fashioned wall rattling, the Jaycar Isobarik lived up to all we expected from its specifications and response plots. It happily coped with very high volume levels in a typically-sized listening room, and when the music source demanded it, produced clean low-frequency energy at the bottom end of its range.

As it turned out though, the sample unit supplied by Jaycar was fitted with the larger 150W amplifier/crossover module, so we didn't get the chance to see how the 65W module handled with this sort of punishment. The enclosure has a respectable sensitivity figure of around 90dB however, so we'd imagine that the smaller amp would be quite adequate for a normal domestic hifi systems and home theatre setups.

We had no trouble in connecting the unit into an existing hifi system, by the way, and found that the amplifier module controls

Our test unit was fitted with a 150W amplifier/crossover module (above), which is the more powerful and elaborate version of the standard 65W unit supplied with the kit.
Left: The 'raw' enclosure with it's base panel removed - it's really quite a clever design.

operated over sensible ranges. This and the fact that the module is compatible with both speaker- and line-level input signals means the Isobarik should be compatible with just about any home theatre or hifi speaker/amplifier setup.

We were also able *sonically* integrate the subwoofer with existing systems without too much effort, thanks to the range of module controls and the linear acoustic response from the subwoofer itself. After carefully adjusting the module's settings, the end result was very extended but quite smooth bass response from the complete speaker setup, with the subwoofer showing no real signs of stress when the system was pushed hard.

Overall then, we'd have to say that from what we've heard of commercial subwoofers costing two or three times the price of the Jaycar Isobarik, it represents very good value indeed. If you're prepared to tackle this type of kit loudspeaker, where you only need to bolt components in place and finish the box to your personal taste, then this must be one of the most cost-effective ways to own your own high-performance powered subwoofer.

The Jaycar Isobarik is available from Jaycar stores throughout Australia, and with any luck there may be an assembled example you can listen to at your nearest Jaycar outlet. For more information on Jaycar's subwoofer kits, check out their 1999 catalogue, or point your browser to Jaycar's website at **http://www.jaycar.com.au**.❖

JAYCAR 'ISOBARIK' SUBWOOFER

A powered subwoofer system available in kit form, featuring two 300mm drivers in a compound or Isobarik configuration.
Good points: *Impressive performance for its size. Will cost you much less than an equivalent commercial subwoofer. Doesn't look like something that landed from Mars.*
Bad points: *You may hurt your back when moving it around.*
RRP: *$569 for the complete kit — add $126 for the beefier 150W amplifier module.*
Available: *All Jaycar stores.*

Sugar cube video camera

What do you mean sugar cube? The *size* of a sugar cube? Surely not! Yes, it's true. The guys at Oatley have impressed us in the past, but this one takes the cake: low size, low power, low cost. This must be the coolest thing to come into the EA office since Rob stopped wearing his sunnies to work...

BY GRAHAM CATTLEY

Since the first phosphor dot glowed on the first CRT, man has wanted to see himself on television. And since the first TV camera was lugged around on some poor soul's shoulder, man has wanted to make the things smaller, and smaller, and smaller...

Over the last two years or so, video cameras have indeed become smaller and more compact, with most of the electronic retailers selling units weighing in at around 35mm square. When we saw the spec sheet on this little beauty, we just had to have one.

Inside the tiny 16 x 16 x 15mm (5/8") cube, with only five pins to connect it to the outside world is a 1/3" CMOS image sensor and enough circuitry to produce a CCIR (288 x 352 pixel) black and white image, with a standard output of 1V p-p at 75Ω.

The pins are simply +5V, ground, and video output. The fifth pin lets you disable the in-built AGC, although why you'd want to do this we're not too sure.

The specs of the C-cam2 (as it's known), are quite respectable, considering its rather, er, small stature: a 2:1 interlaced output, better than 46dB S/N ratio, 10mA current consumption (off load) and an f2.8 pinhole lens with a focal length of 4.9mm.

It boasts an automatic shutter control of 1/60 to 1/6000 of a second, and a field of view covering 56 x 45°, which is more than adequate for the sort of uses it will be put to...

By pinhole, they mean a tiny 3mm glass lens instead of the usual 8-9mm job, and because of its small area less light is collected. This means that it isn't as great in low light conditions, but hey, what were you expecting? Miracles? Manual focusing is achieved by sticking your thumb over the lens faceplate and screwing it in

(continued on page 77)

This 'action shot' shows the sort of focus and resolution you can expect from the wee little thing.

Marco Fabiani, our ever effervescent assistant IT manager is pleased with the results...

Canon's PC745 Personal Copier

Capitalising on the technology developed for its larger office photocopiers, Canon is marketing a range of smaller 'SOHO' models. The PC745 is the middle model in this range, offering many of the features of a larger machine at a price level that's still in the 'personal' range.

BY JIM ROWE

RECENTLY WE LOOKED at the smallest of Canon's 'personal' photocopiers, the FC220 (August '99 issue). This is the 'baby' of their range, you may recall, with a low price tag to match. We found it easy to use, and it certainly gave excellent quality copies — but was ultimately a bit restricted by its moving platen and lack of enlargement or reduction capabilities. In short, a true desktop *personal* copier, rather than one with enough capabilities for small and home office (SOHO) applications.

This being the case, we were grateful for the opportunity to check out the next model in Canon's personal copier range, the PC745. This is about twice the size of the FC220, and with a price tag of roughly double its little brother. It measures 485 x 438 x 286mm, and weighs 20kg (including toner/OPC cartridge). However we're now talking about a copier which offers many more of the features of a full-scale office machine.

For a start, the PC745 is a standard fixed-platen machine, so you can readily make copies from books and magazines that need to be held down gently to keep them flat. The maximum allowable weight on the platen glass is 2kg, but that's roughly the equivalent of a 1500-page telephone directory — quite a acceptable limitation.

The platen glass measures 385 x 233mm, with an active area of roughly 354 x 213mm. This is sufficient to cope with originals larger than A4 size — up to 'foolscap', 'letter' or even 'US legal' size — and the platen escutcheon indicates this, even though the user manual suggests that it can only copy from A4 down to business card size.

The next nice feature of the PC745 is that it includes a 'proper' feed cassette/tray for the copy paper. This is of the familiar front-loading drawer type, with a capacity of up to 250 sheets. It too seems to be capable of accepting paper of up to US legal (216 x 355mm) size, with the appropriate positions for the length and width guides moulded into the plastic (although here again the manual suggests that A4 is the largest size it's designed to accept). The machine is designed to cope with stock of between 64 and 80g/m^2 in the feed tray, by the way.

Apart from the paper cassette the copier also provides a single-sheet 'bypass' input slot on the right-hand end, where you can manually feed in single sheets of heavier paper or light card (up to 128g/m^2), transparency material, sheets of labels and so on. (The next model up, the PC775, has a fold-out stack guide for this bypass input, accepting up to 50 sheets.) This slot has adjustable guides which can be set for any width from 220mm down to about 43mm, giving a lot of flexibility.

Another big plus for the PC745, compared with say the FC220, is that you now have enlargement and reduction capabilities. For speed and convenience there are two handy ratios for enlargement, marked 'B5 > A4' (115%) and 'A5 > A4' (141%), and another two for reduction: 'A4 > B5' (81%) and 'A4 > A5' (70%). This is in addition to the default 1:1 setting, of course.

That's not all, though. Pressing the Zoom button gives you the ability to select from a full range of reduction/enlargement

ratios, from 70% to 141% in 1% increments. So you have much the same facilities in this respect as found on larger office copiers, except that the range may be smaller (some larger machines give a range of 50% - 200%).

What about exposure control and copy density adjustment? Well, as with the FC220 the PC745 offers both automatic exposure control and manual adjustment — here by means of a slider control which can be set when the default Auto mode is disabled. Like the smaller unit it again provides an internal 'preset' control to adjust the Auto control sensing to produce the density you prefer.

The Canon manual says that the PC745 uses the 'Indirect Electrostatic Transfer System', coupled with a Toner Projection System and Canon's 'RAPID' Fusing System. It takes the same E16 and E31 integrated toner/OPC drum cartridges used by its little brother, giving here about 2000 and 4000 'standard A4 page' copies respectively.

When you compare copying speed, though, the PC745 is well ahead of its smaller brother. It's rated at 10 copies/minute, over double that of the FC220, again with virtually no warmup time and about 22 seconds to produce the first copy. This is with manual exposure control, by the way; automatic is claimed to take a little longer for the exposure sensing.

Another nice bonus is that you can now set the copier for any number of multiple copies between 1 and 100, using '+' and '-' buttons (which auto increment or decrement if you hold them down). Very convenient...

The PC745 is very easy to open for cartridge replacement, as the top section swings up 'clamshell' fashion via a hinge system on the right-hand end and a catch on the left. This provides not only access to the cartridge, but also to the main in-line section of the paper path. The initial 'round the bend' section is easily accessible via a fold-down flap on the right-hand end.

Remaining nice features of the PC745 include automatic power turnoff after approximately five minutes of inactivity; a very low noise level when operating; and very low emission of ozone, as a result of new Canon technology to minimise corona discharge.

Rated power consumption of the machine is 980W, by the way, but that's only while it's actually copying. Between copies it's much lower — around 45W, until it turns itself off.

Trying it out

Canon Australia kindly made a sample of the PC745 available for a while, so we had the opportunity to give it an extended evaluation in a typical 'home office' situation (my own, as it happens).

We found it very easy to unpack and set it up, following the instructions in the user manual. The cartridge came already fitted in place, but did need removal temporarily in order to 'give it a shake' and remove the sealing tape. After that it slid back into place, and the top swung down again to make the copier ready for use.

In operation we found it very convenient to use, very quiet and trouble free. As with the FC220 the copy quality has also been very good indeed, and again very comparable with the big Canon NP6050 in *EA*'s editorial office. The B&W detail resolution and greyscale rendition was not *quite* as good, to be sure, but again it's entirely satisfactory for the vast majority of small office and personal copying.

Copying size accuracy was well within the specs of +/-0.6%, too. In fact we measured length errors of consistently less than 0.3% for 1:1 copying, and significantly less than that again for width.

Copying speed was also very impressive, with single-copy time typically only around 11 seconds from pressing the Start button to the copy resting in the output tray. That's even with auto exposure enabled, too.

Copying speed was also very impressive, with single-copy time typically only around 11 seconds from pressing the Start button to the copy resting in the output tray

I measured its power consumption at less than 10W when 'off', around 43W when 'on' but not copying, and about 900W peak when actually copying. Quite economical, really.

In fact after using the review unit for some time, I can really only muster one minor complaint — but it's one that really applies to many photocopiers, even much more expensive models. There's no indication of the paper level in the feed tray; you either have to open it to look, or wait until the machine tells you there's none left. It would be nice to have a small indicator on the front of the tray, as you find on many laser printers, to show the current level...

On the whole, though, and again judged in terms of the requirements of most small office and home office users, the PC745 stacks up very well indeed. It has virtually all of the convenience, performance and functionality most of us are likely to need, including fast operation and enlargement/reduction. And it seems pretty reasonable in terms of running and copying costs — I calculate between 11 and 12 cents a typical A4 copy, not counting the initial cost of the copier itself. ❖

Canon PC745
Personal Copier

A compact photocopier for SOHO users, employing readily replaced toner/OPC drum cartridges.

***Good Points**: Very fast and quiet copying, good copy quality; reduction/enlargement copying anywhere between 70% and 141%; front-loading paper tray with 250-sheet capacity; auto power turnoff.*

***Weak Points**: Nothing significant. A paper level indicator on the front of the feed tray would be nice, though.*

***RRP**: $1449.*

***Available**: Canon dealers, office supply stores. For details contact Canon Australia, 1 Thomas Holt Drive, North Ryde 2113.*

OPEN Fist

BY STEWART FIST

Cell and electro-chemical reactions

After forty years of denying there was any possibility that radio waves could cause health problems, the American FCC (Federal Communications Commission) finally accepted that there are a couple of biomedical findings that now must be accepted as fact.

This is a bit like the Vatican finally admitting Luther was right about Papal fallibility. These two officially accepted facts are now called the 'calcium ion efflux' evidence, and 'acoustic stimulation'. (I'll write about the second of these in another column.)

Calcium is one of the key messenger ions, a critical component of inter-cellular communication in the body and also a regulator of cell growth. It is essential for many internal and external cellular functions: for the transmission of signals between cells; the regulation of intracellular transport of chemical compounds; the controlled release of secretion products; bone metabolism; and without it you can't have muscle contraction.

The phenomenon of Ca++ efflux (external emissions) from cells subject to RF and ELF exposure is well-known and well-studied — especially in the brain and in the lymphatic cells. Raised levels of calcium are found with low-level exposures and with high-levels; in animal studies and in cell-cultures; and known to occur at both mains-power and RF frequencies.

Scientists don't agree about the significance of Ca++ efflux in brain cancer or leukemia, although it is known that the calcium ion is secreted by cells and carried to their neighbours as a messenger to block cell development. Body cells have a inter-cellular voting mechanism for forcing some over-prolific or damaged cells to commit suicide, a process known as apoptosis

Also, within each cell, Ca++ is important in adjusting the rate of ATP synthesis. This adenosine triphosphate (ATP) molecule provides the energy in cells and is essential for building new DNA. It is also known to assist the relay of signals from receptor sites on the surface of warrior cells (lymphocytes) to the cell's nucleus when an 'antigen' is encountered and the warrior needs to clone itself to fight off viral or bacterial invasions.

They can actually see these calcium messengers functioning in some of the largest cells. In 1997, a University of Newcastle (UK) team managed to photograph a sequence of images as a calcium wave swept through a sea-urchin egg when it was 'attacked' by an alien (sperm). They used a fluorescent dye which reacts with the calcium ions.

The images show a wave of calcium ions, fanning out from the sperm's entry point just 15 seconds after fertilisation, and traversing the cell in 36 seconds. It is this wave of excitation that tells the cell it has been fertilised and can begin to divide.

What is worrying about finding excessive calcium outside a cell rather than inside, is that alterations of the function of positively charged calcium ions may indicate that there is an increase in the activity of enzymes which are associated with cell growth — and cancer is the name we give to uncontrolled growth.

Ca++ efflux may also have a synergistic role with chemical cancer promoters (toxic substances), and the excess of Ca++ may directly disturb external hormonal activity. From the scientific viewpoint, Ca++ is easy to detect and measure, and it offers a convenient indicator of cell changes.

There is an increase in the activity of enzymes which are associated with cell growth — and cancer is the name we give to uncontrolled growth

A well-known Australian scientist, Dr Ross Adey (who works in California) has used calcium efflux as a way to measure the effects of RF exposures on cells for many years, and most of his findings have been confirmed independently by scientists in the USA, the UK, and Europe. There may still be conjecture on the consequences, but the calcium changes are consistent and measurable.

Frequency dependent

Back in the early 1970s, Adey found that efflux effects were frequency-dependent with ELFs down at 16Hz. He also found that as frequency increased, the Ca++ levels could rise, and then fall — and then perhaps rise again. This appears to be a resonance effect, but it is found down at the sub-audio range where the wave-lengths are thousands of kilometres.

In the biomedical literature, such regular but reversible changes are known as a 'window effect'. This (or something very like it) is often found with both frequency and power-density changes in both ELF (mains power) research and R/F research — which complicates the experimental exposure problems, because there are often harmonics, modulations, power-pulses and transients also.

In 1979 Dr. Carl Blackman, a prominent US biologist and biophysicist at the Environmental Protection Agency's Health Effects Research Laboratory, found that the ham radio frequency of 50MHz, modulated at 16Hz, would also increase calcium ion release from chick brain tissue in a cell culture. Further experiments established that the power of the tissue's geomagnetic field was critical. Then in 1982, Adey also found the same complex effects in studies using live animals.

The following year, Blackman reported that the 16Hz modulation increased calcium mobility at two power levels, but that one of these power levels coupled with 30Hz showed no effect. Seemingly power and frequency need to be matched in some way. There were also significant 'windows' with

the chick brain tissue at 15, 45, 75, and 105 Hz, and some much weaker reactions at 30, 60 and 90 Hz. These experiments have now been repeated and confirmed many times, but the mechanisms are not well understood.

Later experiments have suggested that the low-frequency ELF window effects are probably related to static magnetic fields, and the only known physical mechanism that could explain the disparity between the 50,000km wavelength and this microscopic reaction of cells is cyclotron resonance (called the Delgado effect).

Blackman's report to the EPA suggests; "If the relationship among the frequency of time-varying magnetic field, the strength of a parallel static magnetic field and the ionic charge-to-mass ratio of an ionic species is correct, then the ion will resonate, or synchronously follow circular paths in a plane perpendicular to the field."

Adey reports that "in the earth's magnetic field, cyclotron resonance frequencies for essential cations, such as Ca++ and K+ are in the ELF range."

Personally I'm not capable of making even the slightest rational judgment on this, but the ideas appear to be treated seriously by the EPA, the FCC, and other biophysical and biomedical researchers.

As mentioned earlier, scientists also know that calcium ions also control the production of a chemical molecule known as ATP, which introduces some similar complications with the ions of sodium and potassium.

Molecular pump

ATP acts as a repository for energy in a cell, and one essential protein within a cell uses the ATP's energy to maintain an electrical balance. This protein acts as a molecular pump; it transports potassium and sodium ions in and out of cells and so maintains the electrical balance across the lipid (fat) molecule membrane.

Each sodium and potassium ion carries a single positive electric charge, but by pumping sodium ions out and pumping a smaller number of potassium ions in (three sodium ions expelled for every two potassium admitted), cells become negatively charged. The lipid membrane, which is only a couple of molecules thick, then acts as a dielectric maintaining a protective voltage across the surface of about 0.1 volts.

Localised changes to this voltage block or admit messenger ions and other essential molecules. Among other instructions, the messengers ions might carry a command for a rogue cell to self-destruct, and if it doesn't it may replicate repeatedly. When cells are constantly dividing (and some do every day), it is essential that an equal number of cells be lost or programmed for suicide, or the human body would just keep growing.

ATP is made by modifying a protein's chemical bond, and, when broken, these molecules generate energy; that's how muscles contract and brains and nerves carry signals. The ions rush to change places, and electrical excitation runs along the length of a nerve cell.

In a hard working individual, ATP is formed and destroyed at the enormous rate of a tonne a day, and ion-pumping across cell membranes is very much an electrically-mediated process. At these sub-micron dimensions, cell functions are on the edge of quantum theory, and very obviously there's still a lot here that we don't know.

That's actually what keeps many top scientists working in this field. It's not just a question of cellphones and health, so much as the prospect that in understanding these interactions, they will go on to make much more significant discoveries about how human cells function at the molecular level.

There's potential here for making vital new discoveries to do with the detection and treatment of various cancer and aging conditions like Altzheimer's, and for the possible use of radio frequencies for their therapeutic value.❖

Forum

Conducted by Jim Rowe

Making it in Australia: comments from one who's done it, successfully

We're taking a break this month from DVDs and region coding, and returning to the subject of hi-tech manufacturing in Australia. I also have an interesting response to the item we had in the February issue about new Swiss watches that read out in 'Swatch Internet Time'...

IN THE JULY issue last year, I wrote an editorial complaining about the lack of dynamism in Australia's hi-tech manufacturing industry, compared with countries like the USA. It was written just after I'd had a quick trip to Silicon Valley, visiting various semiconductor firms, and the contrast had really hit me.

Since then there have been a few interesting responses from readers on this topic, which I've published here in Forum, hoping that it would promote further thinking about ways to ginger things up over here. The last one came from Mr Max Williams, you may recall, and ran in the March column this year.

As you're probably anticipating, there's been another response, partly prompted by the comments of Mr Williams. And this time the comments come from local entrepreneur Roger Riordan, founder of the very successful Melbourne firm Cybec Electronics — known worldwide for its popular 'VET' antivirus software, which was sold to the big US software/systems firm CAI early this year.

It turns out that Mr Riordan has retained Cybec Electronics, and is now looking at developing new hardware or software products. While this is taking a fair bit of his time, he did want to contribute to the discussion, and managed to send in the following comments as an e-mail. I think you'll find them as interesting and relevant as I did:

I will agree with Max Williams (Forum, March 1999) that Australian companies are not generally well managed — I have never yet dealt with a large firm I considered 'well managed', either here or overseas, but I don't think that is the primary reason for the lack of successful Australian companies. In 1973, when I left CSIRO to form Cybec Electronics, Australia had a host of successful electronics companies. We made most of our radios, TVs and whitegoods, using mostly local components, and we had nearly full employment. But then Whitlam, chanting the mantra 'Efficiency', removed the tariffs protecting our industry, and the electronics industry promptly collapsed.

We may have had many inefficient companies, but, as I have been pointing out for many years, the problem facing society is that mass production has made it possible for 20% of the population to produce everything that needs to be produced, and so we have to find ways of keeping the rest of the population occupied, without producing things we don't need, wasting resources, or polluting the environment. So in my opinion the present situation, in which a few people are rich, most of the population are working their guts out for low wages, and the rest are on the dole, cannot, by any stretch of the imagination, be considered an improvement.

In my career I have been associated with two successful products. One was hardware, and the other software, and it is interesting to compare the problems they encountered. The first was an instrument which a friend and I designed at the request of Telstra, and which was subsequently adopted by them as standard test equipment. We had to make about three prototypes, involving several sets of moulds, and it took over a year, and cost at least $100,000, before the first instrument was sold.

The company making the instrument had obtained a loan from the Victorian Enterprise Development Corporation, but when we were in the final stages of development the VEDC became a political dirty word, and the state government wound it up, and foreclosed on all loans at short notice. Fortunately this firm was able to obtain other finance, but a number of other firms were sent bankrupt. There had been a lot of rorting of the system, and the VEDC had invested in several very shonky companies, but it was also funding a number of promising projects, and no attempt was made to separate the sheep from the goats.

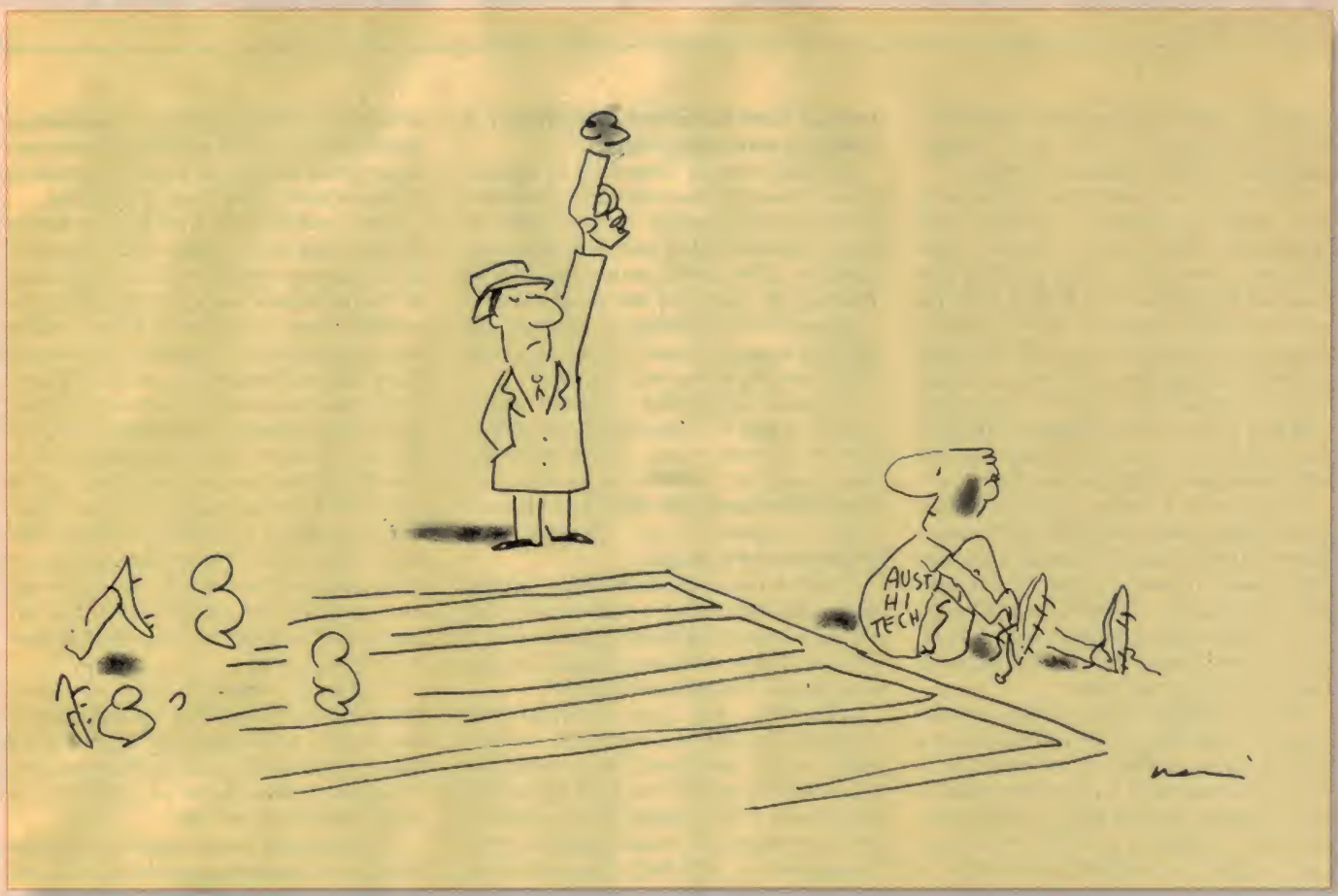
The other product was the VET Antiviral software. I wrote the first version in 1989, while I was a lecturer at Chisholm Institute of Technology, and gave it to the students as shareware. Money began to appear, and at the end of the year I retired to work on VET full time. VET quickly became popular, and Cybec grew rapidly, until at the start of the year, when we sold VET to CAI, we employed about 90 people in offices round the world, and had a turnover exceeding $10,000,000 pa.

So ten years ago I managed to build a successful software company, with a world class product, from scratch; but I am not at all sure it is still possible today. We did not get any significant help from the government, but today their policies seem positively hostile to local industry. Taxes are high, far too complex, and discourage innovation; R&D grants have been cut back, making it harder to fund development, and red tape has increased. One example of this is the quality assurance schemes which various governments require their suppliers to implement. These are of dubious value, especially to the software industry, involve complex recording schemes, and are impossibly expensive for small firms.

Finally 'outsourcing' has become very popular, and is nearly always implemented in a way which seems specifically designed to exclude local firms. Instead of a lot of little tenders we now have a few very large ones, and the size is such that only the multinationals can afford to quote. Invariably they have their preferred suppliers for all the components, so that the only hope for a local supplier is to do a deal with the head office of one of the major tenderers to add them to their list of preferred suppliers.

Recently the scope of the tenders has got so diverse, and the requirements so complex, that it can cost millions of dollars to prepare a response, and even the multinationals are starting to complain. Also the requirements often seem oblivious to commercial realities.

One recent tender, for a moderately high tech product, required that the successful tenderer deposit a surety of $1,000,000 with the customer for 35 years, to guarantee they would be able to service their product for that period. But how many firms today would feel confident that they would still be around in 35



years, let alone be able to pay a $1,000,000 surety? And how many products designed today will still be relevant in 35 years?

At Cybec we gave a lot of young people their first jobs, and a number of migrants their first jobs in Australia, and we got great satisfaction from watching 'our kids' blossom into competent self-confident professionals. We endowed a number of scholarships, and supported other local industries. Nearly all our income remained in Australia, going to people who pay taxes in Australia, but our governments are happy to sacrifice all this on the altar of 'The Level Playing Field'.

Hmmm — thanks indeed for those very informed comments, Roger. I don't know about the readers, but I for one found it very sobering that someone of your experience and demonstrated business acumen isn't confident that your success in developing a product like Vet could be repeated today. That does suggest I was fairly right in claiming the business climate here in Australia still has a long way to go before our hi-tech manufacturing can *really* be resuscitated.

Your two examples are also very interesting, contrasting as they do the relative difficulties of developing hardware and software products, even a few years ago. Not to mention the hassles of getting loans from various government-sponsored 'development corporations'; I've heard many tales of woe about *these*, in the last few years.

On the whole I get the impression that despite their impressive-sounding names, most of these bodies are almost a dead loss as far as small startup companies are concerned — especially if those companies are trying to manufacture hi-tech hardware products. There just seems to be too much bureaucratic paperwork, and too many strings attached to the assistance they are able to give, for them to be of much real help to any firms other than those that are already large enough not to need them! (Although I suspect these are the only firms that *are* in fact able to take advantage of their help.)

Anyway, thank you again for those comments, Roger. I'm sure they'll have provided quite a few readers with food for serious thought.

Internet time?

Now let's look at a topic we haven't even mentioned here as yet, one that's quite different from those we have been discussing.

You might have noticed an item in the 'What's New' column of our February issue this year, with a picture showing a new wristwatch from the Swiss firm 'Swatch' — and explaining that it was claimed as the first to embody a 'whole new concept in measuring time': Swatch Internet Time or 'SIT', promoted as 'global time for a cyberworld'.

SIT was supposed to be a kind of 'new version' of universal time (UT, the latest incarnation of GMT), with the day divided into 1000 'beats' corresponding to one minute and 26.4 seconds of UT, and with the 'reference meridian' passing through Biel in Switzerland rather than Greenwich in Britain. (Surprising, that...)

It sounded a bit weird, with all the hallmarks of a 'nine day wonder' marketing gimmick. Mind you, it was perhaps just the sort of gimmick that might persuade trendy young people about the desirability of buying one of the new Swatches. Especially when it was given an endorsement from no lesser person than MIT's Media Lab founder and director Nicholas Negroponte, well known as a cyberguru and author on the benefits of digital communications and the Internet.

Mr Negroponte was quoted as saying that "Internet time is absolute time for everybody. In the future, for many people, real time will be Internet Time." (Presumably he was forgetting that we've had a pretty serviceable UT for many years...)

Anyway, it appears that one of our readers, embedded systems developer Mr Greg Vigneault, found the whole concept so disturbing that he was prompted to write a strong e-mail drawing attention to its dangers. Here's what he had to say, under the title **'Internet Time: Why Switch for Swatch?'**:

Swiss watch-maker Swatch recently announced its proposal for a new Universal Time standard: Internet Time. It boasts 'No

Time Zones' and 'No Geographical Borders', and is endorsed by one Mr Nicholas Negroponte of MIT's Media Laboratory.

CNN was quick to add Internet Time to its Web page, alongside of Eastern and Greenwich times. Their reporter, Rick Lockridge, was shown asking people if they could tell him the Greenwich Mean Time, the current global standard. Most couldn't. Apparently that should be proof of simplicity for the three-digit Internet Time and its use of the Web-trendy '@' symbol — e.g. @666.

Believe me, if you can't figure out GMT, in your head, you'll run screaming from the calculations needed for Internet Time!

First, you can't convert your local time to Internet Time without using the GMT system. Internet Time is based on Central European Wintertime, as used in Biel, Switzerland (home of Swatch) — which is one time-zone east of Greenwich, England — so where do the 'No Time Zones' and 'No Geographical Borders' jingles come from?

Second, Internet Time is based on 1000 'beats' per day, 000 to 999; each beat is 86.4 seconds. Internet Time aligns exactly with regular time only once in every seven minutes and 12 seconds, and can differ by almost one-and-a-half minutes; e.g. 11:59:59 pm converts to @999, yet @999 converts back to 11:58:33 pm — creating an 87-second void for the Twilight Zone! You could get e-mail at a time earlier than when it was sent.

Third, claiming that Internet Time is 'the same all over the world' is misleading. By raising the issue, it is implied that GMT isn't constant, worldwide. In fact, GMT — the time at Greenwich — is equally independent of where you're standing. Internet Time just moves the reference meridian from Greenwich to Biel. It's just a day that starts at midnight in Biel and is divided into some 1000 arbitrary units instead of hours, minutes, and seconds. While @500 is high-noon in Biel, it's 8pm in Tokyo and 6am in the Bahamas.

Internet Time clearly stands on the shoulders of GMT, and thus it inherits all of the nags of that system — time zones, geographical borders, daylight savings time, etc. Plus, it throws in its own quirks.

Does this describe a 'completely new global concept of time' or a 'revolutionary new unit of time' as quoted by Swatch?

Newsweek Magazine online had this to say:

Gimmicks: Time for Confusion

Swatch entered the digital age last week with a line of watches that keep Swatch Internet Time. They can't access the Net, but models like the Webmaster, Download and Net-time will divide the day into 1000 time-zone-free Swatch Beats, purportedly to help coordinate international chat sessions. "Cyberspace has no seasons", MIT Media Lab founder and Internet guru Nicholas Negroponte opined at the Internet Time launch last year. Neither, it seems, do marketing schemes.

By being virtually impossible to compute mentally, Internet Time may assure brisk sales of Swatch Beat watches — well worth the effort to establish their new Biel Mean Time meridian. 'iTime' clocks are also available for Windows 95, Linux, and even the Newton.

My conclusion: Walking to the 'beat' of a different drummer doesn't always mean that you're keeping in step with the times.

A detailed explanation of how to convert your local time to iTime and a DOS utility to convert to/from iTime, with C/Modula-2 source code, is available on my Web page **http://www.korax.net/~telic**. *You may offer your opinions to Swatch at* **http://www.swatch.com/**.

Thanks for those comments, Greg. I suspect that not too many of EA's readers really needed much convincing about the drawbacks of SIT, but if there were any who did, I'm sure your missive will have done the trick.

Personally, I'm just surprised that Nicholas Negroponte seems to be so keen about such a transparent watch marketing gimmick. Perhaps he's so keen to promote the benefits of the Internet, that he couldn't see the problems of a major change in world timekeeping — or the lack of any real advantages of SIT over the existing UT system.

But perhaps his MIT Media Lab was running low in funding, and Swatch offered a major sponsorship grant if he'd endorse their new product range. Who knows?

Servicing problems

To end up this month, let's return to the problems facing the electronics servicing industry. You may recall that I published a long and sobering letter on this topic in the July column, from Victorian technician Andrew Blight.

Within days of the July issue being published, the following response came as an e-mail from Mr Alan Howard of Stuart Park in the Northern Territory. Mr Howard is also an experienced technician, and I think you'll again find his comments very interesting:

The letter from Mr Blight (July 99), has highlighted some of the problems in the consumer electronics business. Having worked in this industry for 20 years, I have seen the training provided by TAFE remain somewhere in the 1970s. Their apprenticeship course should be re-named to 'Basic old technology electronics'.

The apprenticeship course for consumer electronics (in the NT) does not include VCRs, or CD players, let alone anything that's newer than 10 years old. They expect the trainees to do post-trade courses, at their expense, so that they can repair modern consumer electronic products.

The labelling of the course as 'Certificate 3, consumer electronics servicing' is misleading, in that it does not teach the theory of most consumer goods, and to issue a trade certificate at the end of such poor training is appalling.

I have worked in five workshops in the last 20 years and there appears to be a general apathy amongst employers, towards training. All but one treated it as a way of getting government money to pay for a 'lackey', rather than an opportunity to create a top technician that would make them money in the long term.

The other problem with workshop training is that most technicians don't know properly how the products they repair work (due to shortfalls in their own training). They tend to rely on their memory and fault books, rather than using theory to faultfind problems. This means that about 20% of faults are incorrectly diagnosed and the goods written off. Because of this the apprentices not only get poor TAFE training, but also receive poor on the job training.

Mr Blight's comments about test equipment, or lack of, is another sad reflection on the trade. I personally find a good CRO almost essential for good, professional servicing. It certainly helps on those 20% of faults that others can't fix.

The employers tend to regard test equipment as a non-essential purchase, and I suspect this is because in their day they didn't need it. Unfortunately, for them, technology has advanced a bit from 6CM5s. Nowadays most equipment uses microprocessors to control the rest of the unit via an FC data bus, or similar. A lot use DSPs and other digital based components, and trying to faultfind these with a multimeter and no circuit is almost impossible.

I also started in the electronics industry as an electronic hobbyist at the age of about 10. I was designing and building projects by the time I was 15, out of old TV sets, I also had a primitive 5MHz CRO. This, however was a hindrance to my career. I had been doing casual repairs for a repair shop during school holidays during my early teens and thought that this would help gain an apprenticeship in electronics. This did not happen.

Instead, when I finished schooling I got a full time job with the shop mentioned, but was not offered any training. Instead I was expected to do a tradesman's job and get paid labourer's rates for doing so. This went on for several years, with some wage rises (but not to trades wages) until I left to work in another shop for award wages.

I still do not have a trade certificate, but have done several courses from TAFE so that I at least had some 'pieces of paper'. Most of my knowledge is self-taught, usually from expensive technical textbook publications (from RS and Farnell), and manufacturers literature.

(Continued on page 77)

SERVICEMAN

Restoring a Lavoie LA-265 oscilloscope, and a hifi system that bites back!

Not many would tackle the restoration of a piece of gear containing 90 valves, but our first contributor did, and brought an old Lavoie scope back to life. Our other story this month highlights the problems and dangers in earthing audio equipment — as you'll see, we are lucky to have this story at all...

It seems that the availability of modern digital scopes has not killed the value of old, even ancient, equipment. A few months back I used a story about the restoration of a top-of-the-range Tektronix oscilloscope. This month we have a story about the rebirth of an even older, valve powered scope.

I recall that my first scope had a bandwidth of about 25kHz and used nine or ten valves to achieve its results. This story comes from Lex Cunningham, of Dianella in WA, and he tells about a contemporary unit with 1000 times the bandwidth and ten times as many valves!

I have a story I would like to submit to your column concerning the restoration of an early sixties valve oscilloscope which was recovered from a junkyard and is now back in service.

I think it is a lesson in that with persistence and a little luck, valve equipment can be restored and be just as useful as more modern equipment.

I am an engineer who was trained on silicon only, but I have a fair amount of hobby experience with valve equipment such as radios and TVs. A group project I am involved in is the restoration to working order of a Bendix G-15 valve computer.

This project came about for a couple of reasons — my interest in glowing bottle technology, and the need for an oscilloscope to assist in the restoration of obsolete computer systems.

I am a member of the Western Australian branch of the Australian Computer Museum Society; a body dedicated to the preservation of obsolete computer equipment ranging from mainframe systems to PCs.

It was during one of the open days, where computers are tested and brought back to life, that I came across a Lavoie Laboratories LA-265 oscilloscope, purchased for $5 at a scrap metal yard.

The LA-265 is a large and heavy scope with dimensions of 420mm high, 330mm wide, and 600mm deep, and weighing 30kg. Lavoie Laboratories was a test equipment manufacturer based in Morganville, New Jersey, USA.

The scope was designed to take a variety of plug-in preamplifier modules and had a dual channel preamplifier installed. Removing the preamplifier confirmed my suspicion that it was a valve scope. Removing the covers revealed valves covering most of the various chassis'. A count showed there were ninety little bottles in all.

The scope construction is quite professional with all valve types and adjusting potentiometer functions screen-printed on a thick aluminium chassis. Each major function is allocated its own chassis.

An interesting aspect of the scope is the delay line, which consists of a multi-tapped inductor with fifty trimmer capacitors. Imagine having to align each section! The top panel of the preamplifier cage even has a clip with an Allen key in it so that loose front panel knobs can be tightened!

The repairs started by blowing out the small amount of dust that had got through the filter and fan assembly mounted on the rear panel. I found a date indicating the scope was manufactured in 1962.

A new power cord was installed to replace the original, which had been cut off.

The fan was dismantled for regreasing and the metal mesh filter washed.

Visual inspection showed one of the power supply valves was completely black internally. This was a 5651, which turned out to be a voltage reference type. This was tested and showed a breakdown voltage of around 140 volts.

The scope was switched on, the DC power rails checked, and found to be reading low. A blown fuse in the -150V supply was replaced, with the supply now at -180V and the 500V supply showing 650V. A quick check of the CRT showed a trace containing mains hum, indicating a power supply fault.

The power supply was traced out to reveal that it delivered five fully regulated voltages using 1284 and 6080 power triodes as series pass regulators, 6AU6 pentodes as error amplifiers, and the -150V supply as a reference.

The positive voltage regulators use a voltage divider network, built from 1% resistors, from their respective outputs to the -150V supply to drive the grid of the 6AU6 error amplifier. With a few hundred volts across the resistors, it was not surprising to find most had drifted high.

I replaced the resistors, but the -150V supply remained fixed at -180V. I then realised that the designer would not have used a 140 volt reference for a 150 volt supply. The reference valve is used in a differential amplifier built from a 12AX7 dual triode, with feedback from a potentiometer to trim the -150V supply.

A calculation showed the centre of the pot would be at 85 volts. Some Zener diodes were arranged to give 85 volts, and the feedback pot cleaned and regreased to fix an open circuit wiper. This restored all DC supplies to normal.

After this, the scope would not display any trace, and it was obvious the EHT supply had stopped working. I borrowed a high voltage probe to adjust the potential on the CRT cathode to -1350 volts. Adjustment was made necessary due to the replacement of the 1% resistors in the power supply, and hence changing the supply voltages. This restored the CRT supply but there was still no trace.

It was during further testing that two of the rectifier surge protection resistors went up in smoke. Testing with an ammeter showed a large current from the positive of the 350V supply into the negative of the 500V supply. In this power supply, the 500V supply is added to the 350V supply to reduce the ratings of the components, and hence the cost.

Replacing the 500V supply rectifiers did not cure the problem and the fault was traced to an inter-winding short in the power transformer.

I was thinking along the lines of an expensive rewind, but decided to tackle the transformer anyway, even though it was an encased type. Around thirty connections were removed from the ceramic feedthroughs and the transformer removed.

After much work with a gas torch and hammer, the transformer was freed from its case, to reveal that it had been encapsulated in varnish. I chipped away at the varnish around the offending terminations and found the cause of the short.

During manufacture, the assembler had cut the flying lead sleeving short, stripped back the enamel insulation too far, and routed the wire over the top of the adjacent terminal. This was easily repaired and the transformer placed back in its case, and given a fresh coat of paint.

There was still no trace on the screen, so I started emission testing the valves. The most common valve was an ECC88, a dual RF triode, and four from Timebase A were showing low emission levels.

Replacements did not help, but switching to Timebase B brought up a trace and proved most of the scope was operational.

One control that does not appear on modern analogue scopes is a stability control. This was adjusted and Timebase A burst into life. The high frequency performance of the trigger was disappointing, but this was mainly corrected by tweaking the lockout level control.

The trace was levelled by loosening the clamp on the CRT and rotating the tube until the trace was level with the graticule.

A good clean up of the panels and covers returned the scope to a quite presentable condition. Bandwidth testing revealed the scope has a -3dB point of 25MHz which should be enough for most of the fault finding purposes the scope will be put to.

One definite use will be in the restoration of the late 1950's Bendix G-15 valve computer. However that is another story in itself.

So! There you have it. Any piece of equipment can be brought back to life if you are prepared to spend the time and effort on it. And, of course, you need a little bit of luck.

If you remember our last CRO story, Eric Baynes was lucky enough to find a device in a photocopier that helped him to restore the old Tektronics instrument. In Lex's case, he was lucky to find the transformer was repairable — I don't think he would have gone to the expense of a rewind.

Thanks for that story Lex. I for one found it quite interesting. Those old CROs certainly had complicated power supplies. I think we'll find the new digital instruments much simpler in that department.

And what about a report on the old Bendix computer? That sounds as though it might be interesting.

Smoking hifi

The next item this month comes from our frequent contributor Peter Lankshear, well known to readers as the former author of the Vintage Radio column. As you might expect, Peter's story is all about valve type technology, but relates to a quite recent occurrence.

Have you ever encountered the situation whereby an apparently simple fault can create a potentially lethal hazard due to damage it did to a separate piece of equipment?

Last week I had decided to relax with a coffee while I read my copy of EA and had fired up the family hi-fi for a bit of pleasant background listening.

The system is in a cabinet with shelves housing a heterogeneous collection of stand-alone units; the usual CD player, tuner, tape player and an excellent control unit, a Sansui C1000.

I guess that it will be no surprise to regular readers that in the bottom of the cabinet lurks some valve technology, a massive amplifier of my own design and construction, an all-triode beast with a pair of the classic 6A3's in each channel.

To complete the setup there's a pair of large reflex cabinets fitted with monstrous and efficient Tannoy 15" Dual Concentric speakers and which to my aging ears deliver a very satisfactory sound.

A mighty roar from the speakers suddenly and violently interrupted my reading. I looked up to see clouds of evil looking smoke erupting from the amplifier.

I made a dash for the cabinet and none too gently unplugged the mains and connecting leads from chassis and rushed it outside to some fresh air.

A post mortem soon revealed the culprit. The power supply is wired for a traditional octal based rectifier, but recently I had plugged in a solid state replacement, each section comprising two series connected 1000PIV, 1 amp diodes, complete with the usual balancing resistors and spike suppressing capacitors.

Although the rating of the rectifier was conservative, one diode apparently failed, and the rest followed in a chain reaction. The power transformer, with its high-tension winding rated at 2 x 450V at 0.25A packed a lot of energy and had destroyed itself with great rapidity.

Fortunately, damage was apparently confined to the transformer, and equally fortunately I had originally acquired a pair of the monsters. Replacement with the spare was soon completed and this time fitted with a trusty GZ34 rectifier, the amplifier was successfully tested in the workshop.

I anticipated that refitting the amplifier would be routine, with no thought that the event would be sufficiently remarkable to provide a story for this column.

However, with everything reconnected, firing up the system produced from the speakers, the unmistakable 50 Hz roar created by unshielded grid leads. At first I thought that my unceremonious disconnecting had damaged the connecting leads, but this was not the case.

In fact, the problem proved to be in the control unit output sockets. Their shells were no longer earthed!

An obvious conclusion was that somehow, the fault had damaged the control unit. The sockets are insulated to minimise multiple earthing and I suspected that there would be a damaged printed circuit track somewhere on the board.

Such proved to be the case with about 1cm of track completely vaporised. This was soon repaired and the system restored. Now the question remained as to why an amplifier fault had damaged the control unit?

Disturbing evidence

Piecing together the sequence of events led to some disturbing conclusions. Initially, the transformer failure had caused a short circuit between the primary winding and an internal earthed electrostatic shield. Normally this should have immediately blown a fuse but the chassis was not directly earthed, for reasons that I will explain.

As is commonly the case, to "family-proof" operation of the system, mains switching of the various units is controlled by the control unit master on/off switch.

As is also frequently the case with imported equipment, the controlled mains outlet socket has only two pins and consequently provides no earth connection.

In practice this can be an advantage, for multiple earthing between units can create hum loops. I had therefore simply fed the controlled equipment from this socket, relying on the braids of the shielded signal leads to provide a connection to the mains earthing via the control unit mains lead.

As surges created by capacitor input filters in electronic equipment power supplies at switch on can make simple fuse protection difficult, overall protection was provided by a circuit breaker on a distribution block.

This arrangement operated well, with no hum problems. However, when the diode failure damaged the transformer, the fault current travelled to earth by way of the amplifier input leads, through the control unit PC board and thence to the control unit case and the mains earth.

The circuit breaker had insufficient time to trip before the fine printed circuit track acted as a quick action fuse.

Now we come to the disquieting bit. With smoke billowing everywhere, I had not bothered to switch the mains off. With the connection to earth from the main amplifier chassis gone, the chassis itself would have been live, and I had grabbed it to unplug the connections.

Fortunately, the chassis consists of an aluminium deck mounted on a mahogany plinth, and it was the wood that I had grabbed. Also, the room is well carpeted. Had the amplifier been all metal, and the floor less well insulated, I might not have been writing this story.

This leaves some problems, not only for me, but also for other audio enthusiasts with similar equipment configurations.

Most items of audio equipment have a mains transformer which could conceivably fail at any time, possibly creating a similar situation if any earthing is via a printed circuit track.

Electrical authorities insist with good reason that all metal cased equipment should be connected to the mains earth. However this is a likely recipe for hum.

Designers of professional audio equipment solved the problem more than half a century ago by interconnecting all amplifiers with balanced pair cables and solidly earthing all metalwork. Apart from microphone circuits this expensive refinement is rare in amateur and domestic equipment.

My own remedy now is to retain one point earthing, but make sure that every unit individually has the lowest practical current fuse fitted, and to make sure that any earthing is not carried by a printed circuit track.

Finally I will insist that in the event of trouble all equipment be first switched off at the mains.

Amen to that, Peter. And I thank the fates that led you to grab the wooden base rather than the metal case.

I'm of two minds about single point earthing and the so-called double insulation. I know about earth loops and hum, etc., but I am dubious about the wisdom and safety of relying on the screens of signal leads to provide earth returns.

I grew up in the days of three-core cables and three pin plugs and it's hard to accept that anything less is safe. Still, there are millions of two-core installations that haven't killed anyone (yet) so they must be reasonably safe.

And finally, how lucky was Peter to have a spare power transformer on hand. I presume that it was (or had been) a standard type because even common types of big trannies were expensive. It would have been uneconomical to shelve a couple of hundred dollars worth of transformer against the rare chance of needing it in the future.

But I'm glad you did put it away, Peter. Because otherwise we would not have had your story. Thanks for that.

And that's it for this month. I don't know what next month will bring, but you can be assured that it will be interesting.❖

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2-pin DIN Plug

Right angle, screw terminals. 24V DC @ 2A.

P 1521

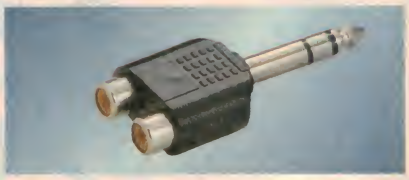
$1.40 NEW

F59 Line Plug, Screw Terminals

75 ohm coax plug, as used for cable TV.

P 2090

$2 NEW



6.5mm Stereo Plug to 2 x RCA Sockets

A handy plug that allows connection of headphone outputs to RCA leads.

P 6585

$2.95 NEW

LES Globe Holders

Pack of 5 miniature globe holders, ideal for model makers.

P 8172

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AF Computer Lint Free Tissues

Not for your nose, these tissues are for cleaning your PC or office equipment. Pack of 50 tissues, 210 x 190mm.

N 3120

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AF Foam Clean

200ml can of foaming cleanser lifts dirt from common office surfaces. Ideal for your PC's, printer's and fax machine's beauty routine.

N 3121

$14.95 NEW

JUST ARRIVED

CCD Camera Module

B&W with IR LEDs. Ultra small size allows for simple application and installation. Built-in electronic auto iris for automatic light compensation. 380 TV lines, 1 Lux illumination, size: 40mm x 35mm.

L 5872

$99

CCD Camera Module

B & W camera with extremely low power consumption, omni-directional audio pick-up, no blooming or burning and adjustable focus. 380 TV lines, 510 x 492 pixels, 0.1 Lux minimum illumination, F1.8 lens, size: 32mm x 32mm.

L 5873

$109

RolaCase Tool Box

Fantastic case with 21 compartments, ideal for tradesmen and their supplies, fishing tackle, art supplies and more. Also allows expanding with expanding rack.

H 2521

$44.40 NEW

Converter 24V to 12V DC

Rated at 20A. 25A surge. Ideal for running standard car accessories in trucks.

M 9814

$155 NEW

Made in the USA, high strength cable joiners.

Posi-Lock Connector

Suits 18G-24G size wire.

H 6721

$2.70 NEW

Posi-Lock Connector

Suits 12G-18G size wire.

H 6722

$2.95 NEW

Posi-Lock Connector

Suits 8G-10G size wire.

H 6723

$3.25 NEW

DICK SMITH ELECTRONICS

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DICK SMITH ELECTRONICS

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- Use your PC to layer text over a video signal. Ideal for video titles, etc.
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K 5417

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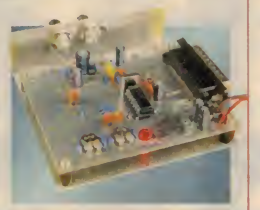

EA Aug '99

Bracket shown not supplied with kit

Auto Headlight Switch

- Headlights automatically switch on at reduced brightness when car starts.
- Dark sensor switches lights to full brightness at night time and in low-light conditions.
- Powers headlights rated up to 200W total and EMI suppressed. • Headlight switch works normally and overrides circuit operation.
- Daytime lights activated only after engine starts.

K 4309

$48.95

SILICON CHIP Aug '99

Sub-Bass Processor

- Add oomph to your home theatre with this kit!
- Correct and enhance the low-end response of sub-woofer-style speakers.
- Can be easily installed in an existing amp, powered sub-woofer or just build it as a free standing unit.
- Includes a bypassable filter, variable gain (+/-12dB) input stage and more.
- Can be driven from speaker or line level input signals.

K 5403

$24.50

NEW

EA Sep '99

15W "Brick" Stereo Amplifier

This compact unit delivers 15W per channel in stereo, so you can add extra channels to your home theatre setup, eg rear or centre speakers. Easily hidden due to its size, it accepts line output from any source. Also great as a bench amp. Use this with your Surround Sound Decoder kit (K 5409) for a low-cost home theatre setup! Includes deluxe pre-punched black case, front panel label and all components.

K 5609

$93.50

EA Jun '99

Mains Monitor

- Great for rural areas or where applicances need to be protected against mains fluctuations.
- LED meter to indicate voltage level.
- If voltage falls outside pre-set range, power is switched off.
- User-selectable delay time.
- LED indicator shows if switch has been activated.
- Includes punched & screened front panel, case, and all components.

K 7207

$99

EA Jun '99

Kit ESR/Low Ohm Meter

- A smart circuit which is capable of measuring an aspect of electricity capacitor performance which normally is very difficult to check.
- The circuit can also double up as a 'Low Ohms Meter'.
- Kit is supplied in full form complete with all components, hardware PCB, case and pre-punched silk screened front panel.

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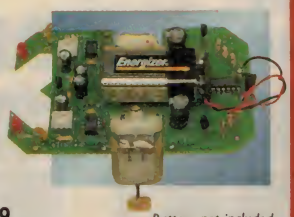

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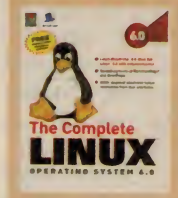

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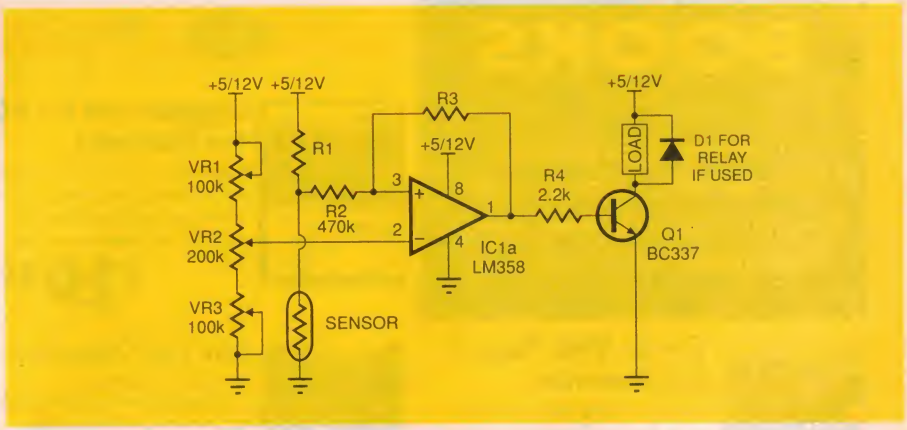
Circuit & Design Ideas

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

Using salvaged VCR sensors



My local video repair man recently told me of a circuit he has been using for a few years now, which uses a part salvaged from retired video machines; the dew sensor, normally used to prevent the machine operating in very humid conditions.

This component is usually a ceramic wafer roughly a millimetre thick with metal tracks fused onto it, and a moisture sensitive layer on top. They have two wires coming out of them, can be as small as 6mm square or up to about 15 x 25mm in size, and the colour of the top coating is generally black, brown, grey or clear. They are usually found in the vicinity of the tape head drum.

Of the different types we've tried they are mostly resistive in nature, and can vary from around 800 ohms increasing to 200k, to many megohms decreasing to 1k - 200k or so with varying humidity levels. The circuit commonly used with these sensors is a simple comparator.

We have put together a basic circuit using an LM358 dual opamp as a comparator, but only one half is actually drawn here. The inverting input is biased at around half the rail voltage by the combination of VR1, VR2 and VR3, while the dew sensor is biased by R1 and connected to IC1a's non-inverting input via R2. Feedback resistor R3 provides hysteresis with R2 and therefore a Schmitt trigger action, while R4 limits the output current to the base of Q1.

The same circuit will work with an LDR or NTC thermistor (10k or 100k), and VR1 to VR3 should provide more than enough control to set the trigger point for most applications.

For a low resistance dew sensor (1k to 200k) the relay will be activated with more humidity. Here, make R1 = 22k to 100k, and R3 = 10M.

For a high resistance dew sensor (200k to megohms) the relay will turn off with increased humidity. Make R1 = 100k to 4.7M, and R3 = 10M.

For an LDR the relay will turn on as the light level falls. Make R1 = 270 ohms to 100k, and R3 = 2.2M to 10M.

For a 10k NTC thermistor the relay will come on as cooling occurs. Make R1 = 1k to 56k, and R3 = 4.7M to 10M.

The above values are variable due to the resistance of the sensor(s) at the users defined set (trigger) point. As a rough guide, try to match the sensor bias resistor (R1) with the resistance of the sensor at the trip point you want - for example, a 10k NTC thermistor at 25 degrees C is around 10k.

Fragile!, fragile!, fragile!; if you find a sensor with a grey loop track, the grey coating rubs off very easily, and with most of the other types the solder pads can break off without much effort.

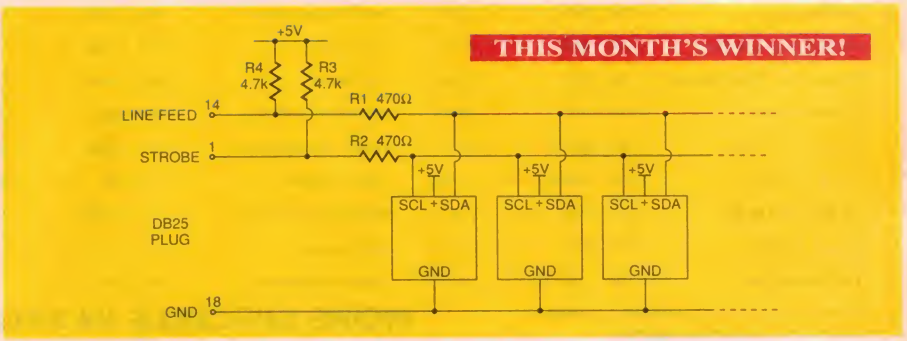
If readers are interested I can supply a small PC board for this circuit, which drives two small relays (either 5V or 12V) onboard. It will fit into a 120mm x 65mm x 35mm Jiffy Box.

Thanks to Leo Forbes EUROBIN VIC.

Write to Michael Jeffery EUROBIN VIC. C/O RMB 5811 Myrtleford Vic 3737 **$25**

Let your PC talk to I²C devices

THIS MONTH'S WINNER!



There are specialised I²C interface cards available for PCs and they often cost over $500. Here is how to interface to the I²C bus for almost nothing.

Back in June 1993, *Electronics Australia* published a small mod to enable an IBM-compatible PC to talk to Dick Smith's Teletext Decoder, using the Parallel port of the PC to emulate the I²C bus protocol.

Several people have asked me if the June 1993 software could be adapted to talk to *any* I²C device. The answer, of course, is yes. There is no reason why a similar setup could not be used to talk to any I²C device. All you need is four resistors (R1, R2, R3 and R4) and a bit of software. If you wish to 'break in' to a device that has an existing I²C master, you should use a circuit similar to that in the June 1993 article, as it is not possible for the PC interface to recognise another I²C master on the bus.

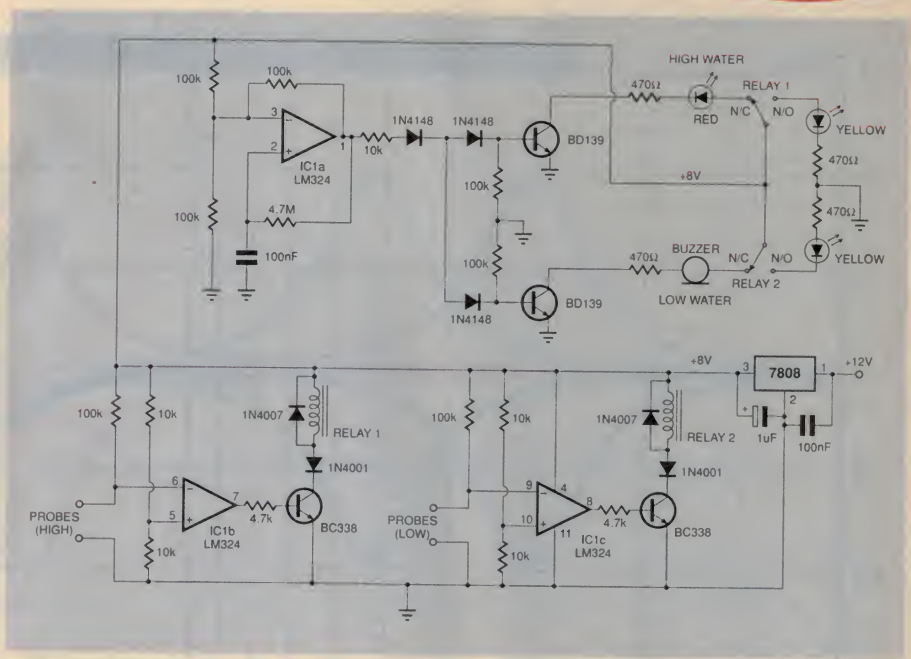
What can you do with I²C devices? Well, almost anything: a cursory glance over the Internet reveals LED and LCD drivers, D/A and A/D converters, I/O ports, clocks and event counters, RAM and EEPROM memory, thermometers and DTMF tone generators. Other devices relate to mobile phones, voice synthesizers and Teletext decoders, while others are designed for use with TV reception and frequency synthesizers. (Whew!)

To demonstrate the ease of interfacing I²C devices, I cobbled together on a breadboard a simple circuit that contained three I²C devices. These can be all controlled simultaneously by the PC's parallel port, as each I²C device has a unique address. (Although most can have part of their address altered externally. For example, the PCF8583 clock/cal-

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is an open order to the value of $300 from Oatley Electronics! Yes, that's $300 to spend on anything you want from Oatley's wide range of products, so check out their ad (or their Website) to see what's on offer.

Win our 'IDEA OF THE MONTH' Prize!

Water tank level monitor



This circuit came about because of the need to alert the owner of a campervan that the water level in the water reservoir is becoming critically low, especially when the campervan is being used in the outback away from a renewable water supply.

The circuit description is as follows:

IC1a is configured as a free running low-frequency square wave oscillator, running at about a 1Hz rate. The oscillator output is connected to both BD139 transistors that in turn pulsate the red LED and/or the buzzer, depending on the status of the relays.

IC1b & IC1c are wired as comparators, which detect water on their probes. If there is water present on the probes the outputs of the comparators will be high, thus turning on the relay coils via the BC338 transistors.

Why use relays? To make the circuit as failsafe as possible; because if the coils of the relays go open circuit, then either the buzzer or the red LED will sound or flash depending on which relay coil goes open circuit. The relays need only to be PCB mount relays.

The probes could be set up in the reservoir in such a way that the 'high' LED probe is placed say half way up the height of the reservoir, and the 'low' buzzer probe is placed near the first 2 inches from the floor height of the reservoir, therefore alerting the owner that the water level is running critically low.

When both sets of probes are wet since reservoir is full, then the relays will be energised and the yellow LEDs will be on, indicating a full reservoir.

Now for example, if the water level drops below the 'high' probe, but not the 'low' probe, then relay 1 will disengage. The red LED will therefore flash and the 'high' yellow LED will go out, indicating the water level has dropped below the high level. Then if the water level has dropped below the 'low' level as well, simply because of heavy use of water supply, then relay 2 will also drop out. The buzzer will then sound at a 1 pulse per second rate, as well as the yellow LED extinguishing, thus alerting the owner of the campervan.

The 7808 voltage regulator simply supplies a stable 8 volts supply to the comparators. The relays are a 5 volt coil type.

Peter Howarth
Gunnedah, NSW **$30**

endar IC has two possible addresses, either x'A0' or x'A2', depending upon the setting of its A0 address line)

As you can see from the circuit, almost no 'glue' components are required; you just ensure that the device has a unique address, and connect its SCL and SDA lines to the bus.

This circuit works best with fully compatible 'Legacy' parallel ports. For it to work with an EPP port the connection to pin 14 needs to go to pin 2 instead. This is to enable the use of the bi-directional data lines for the SDA connection.

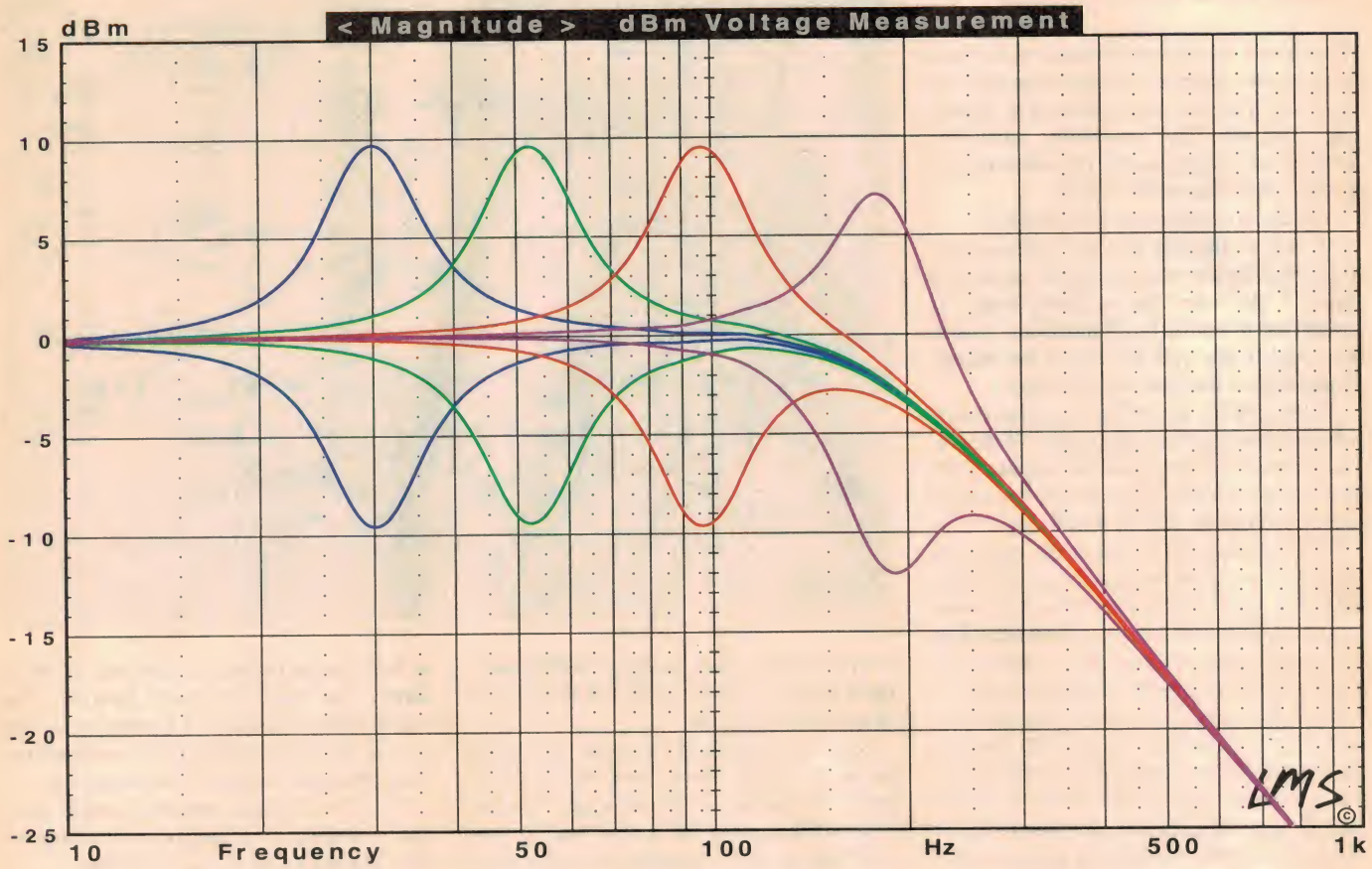
If your EPP port fails to operate, try removing R3 and R4. If it still refuses to work you can short out R1 and R2; however you are now probably exceeding the I²C drain limit. The best option is to find a Legacy port (try that old XT you have out in the back room). To change the configuration of a newer printer port, use the computer's BIOS setup program. To change the address of an older style port, you will need to alter the DIP switches. Regardless of the kind of port you use, do not try to use your printer at the same time, I have not attempted to allow for this.

The software is available for downloading from EA's WEB Site as the file IICSOFT.ZIP. It includes the interface subroutines and a simple program to demonstrate the operation of the circuit above. The software begins by identifying the addresses of all I²C devices connected; this simple test will quickly identify any 'dead' components. It then performs some simple I/O on three demonstration devices, provided they were identified.

If enough interest is expressed I will create a version of EXEC (see the EA June 1993 article) for this generalised I²C interface software. Also, the Teletext software is still available, but not from the address in the 1993 article. Please Email mark_eynden@hotmail.com for more information.

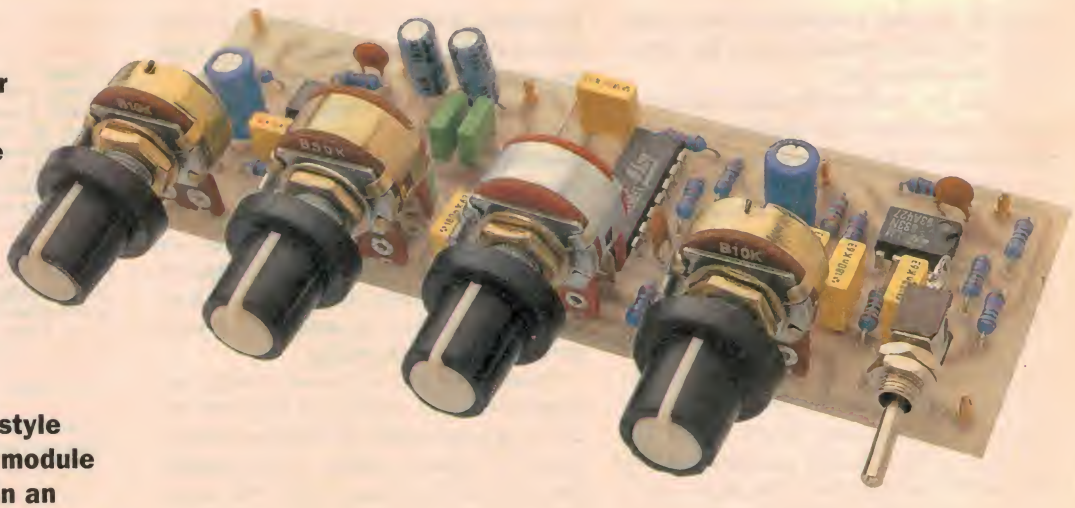
Mark van der Eynden
Mt. Waverley, Vic. **$30** ❖

Sub-bass Processor



BY ROB EVANS

Get the most out of your low-bass speaker system, subwoofer or home theatre setup with this small but very effective audio 'toolkit' for low frequencies. Designed to both correct and enhance the low-end response of subwoofer-style speakers, this low-cost module can be easily installed in an existing amplifier or powered subwoofer, or just built up as a free standing unit.



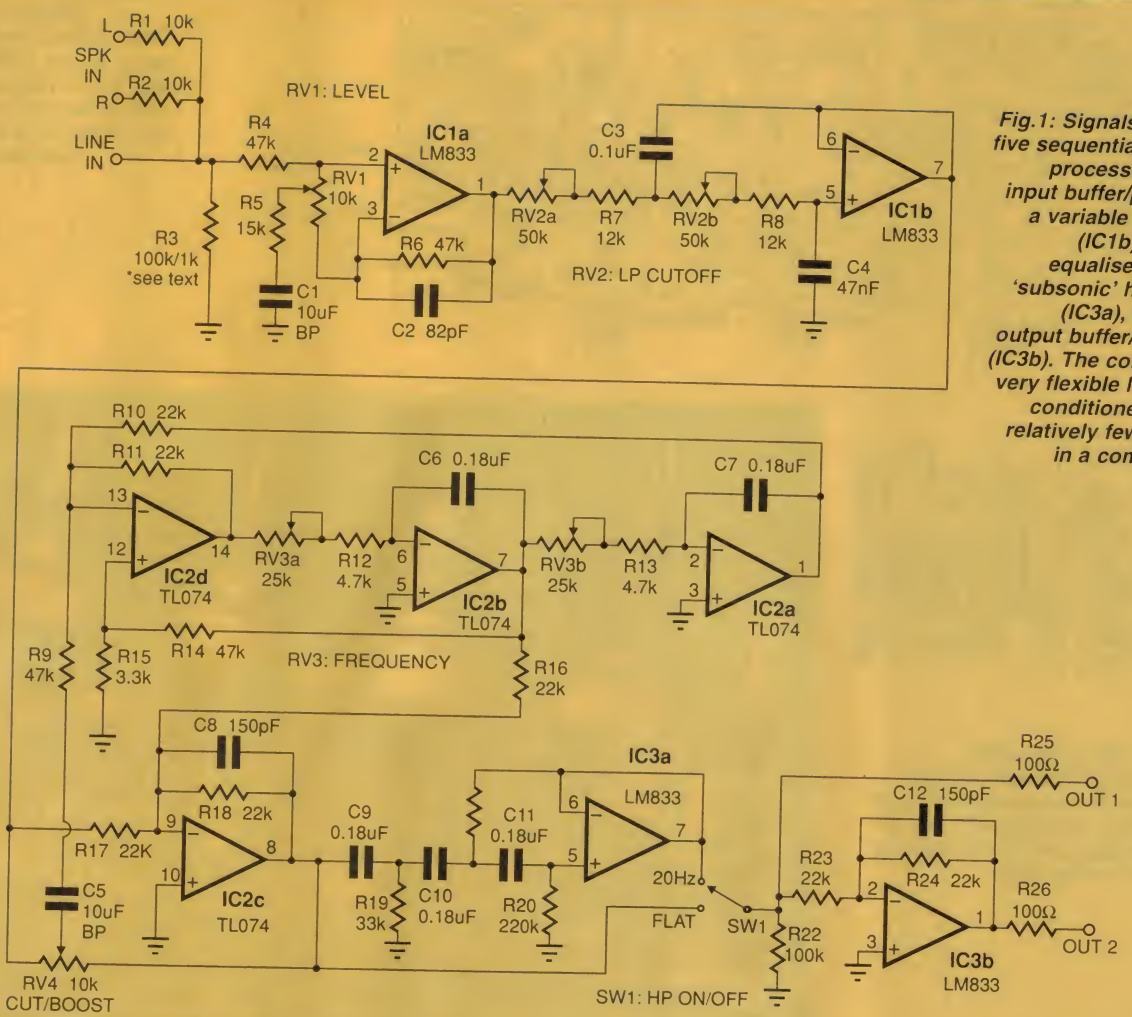


Fig.1: Signals pass through five sequential stages in the processor's circuit; an input buffer/preamp (IC1a), a variable low-pass filter (IC1b), a parametric equaliser (all of IC2), a 'subsonic' high-pass filter (IC3a), and finally, an output buffer/inverter stage (IC3b). The combination is a very flexible low-end signal conditioner, which uses relatively few components in a compact module.

If you've experienced the extra depth and impact of an audio system equipped with a dedicated low-bass speaker system, you're probably pretty keen to get one for yourself — if you haven't done so already. The aural improvement is often at its most dramatic in a home theatre system, where the soundtrack of recently-released feature films exploit the very low-end of the audio spectrum, to enhance the atmosphere and intensity of the on-screen action. It's riveting stuff, and part of what makes a full-sized cinema a memorable experience.

Dedicated low-frequency speakers can also work extremely well in hifi systems, of course, where small main speakers in particular benefit from the octave or so of bass extension added by a subwoofer. As ideal as this sounds though, when it comes to integrating a low-bass speaker into an existing system, many people find that they just don't get the smooth and extended low-end response they'd hoped for...

This lack of promised low-end performance can be due to a variety of factors, the most likely culprits being unfavorable room acoustics or a poor frequency response from the subwoofer itself. Even if a bass speaker sounded great in the hifi store and has response graphs to back this up, you're still likely to end up with a lumpy, soggy or lightweight bass performance thanks to the detrimental room dimensions.

Of course, moving the subwoofer to the centre of the room may help, but this is sure to be an 'unpopular' arrangement for others in the household. The way that a typical lounge room compromises the performance of dedicated low-frequency speakers really is their achilles heel, and no amount of heavy drapes or acoustic padding will really help — the low-frequencies just go straight through, and their long wavelengths continue to react directly with the room.

However in all but the most extreme cases of this problem, a moderate amount of equalisation applied in just the right frequency area can make a huge improvement in the system's low-end response. As you've probably gathered this is the basis of our new Sub-bass Processor presented here, which is specifically designed to condition low frequencies for sub-bass speaker systems.

Along with the equaliser, this small mod-

Specifications

High-pass (subsonic) filter:
20Hz cutoff.
-18dB/octave rolloff slope.

Low-pass (subwoofer) filter:
40Hz to 200Hz cutoff (variable).
-12dB per octave rolloff slope.

Lower frequency limit:
about 1Hz (HP filter switched out).

Gain: -12dB to +12dB (variable).

Equaliser:
12db boost or cut (variable).
30Hz to 190Hz centre frequency (variable).
Q of 5 (set by resistors).

Distortion and noise:
0.03% THD, -92dB unweighted (ref 1V)

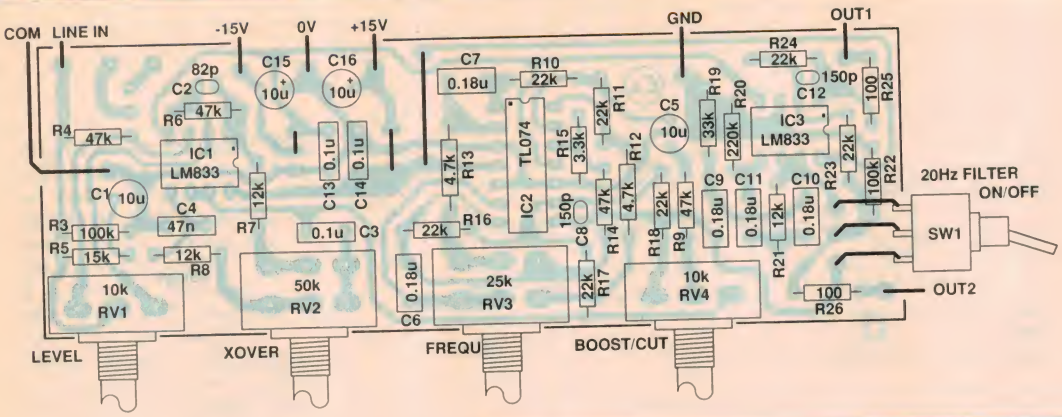
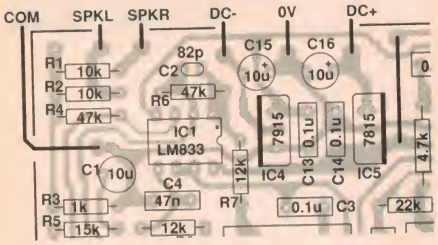


Fig.2 (left): The overlay diagram for the Processor board when setup to use a line-level input plus a regulated +/- 15V DC supply source - as in the prototype unit shown below.



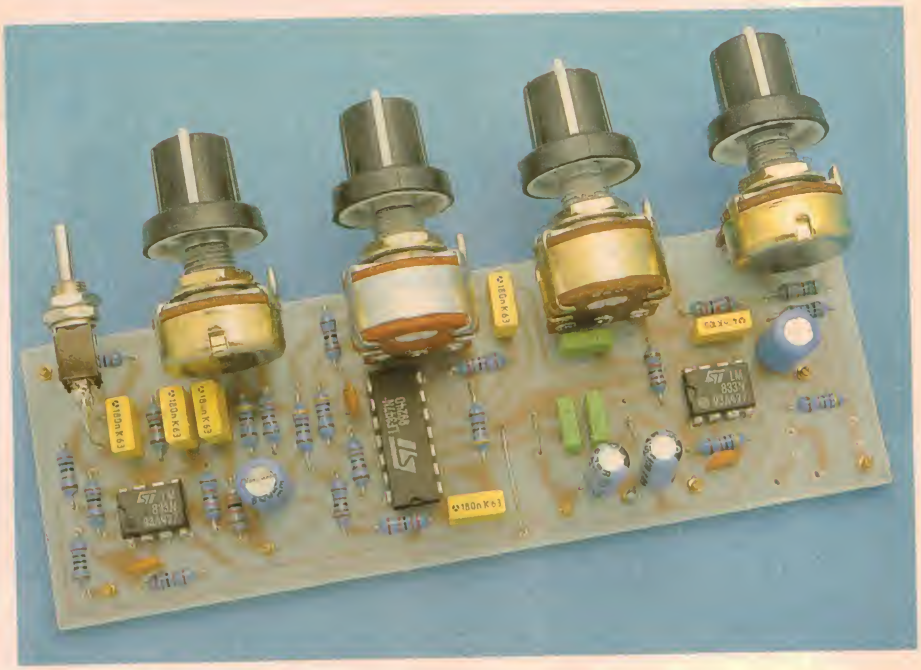


Fig.3 (above): The component arrangement needed for speaker-level input signals and/or an unregulated (+/-) DC supply source. Note that R1, R2, U4 and IC5 are installed, and R3 is set to a value of 1k rather than 100k.

ule includes a 'bypassable' subsonic filter set to 20Hz, a variable low-pass (subwoofer) filter, a variable gain (+/-12dB) input stage, plus dual-phase outputs for running amplifiers in bridged mode. As you can see, we've managed to put a lot of function into a small package.

When connected in the signal path to a low-bass amplifier/speaker combination, the Sub-bass Processor can be used to improve the system's performance in a wide variety of ways, as you can see from the associated graphs. By careful adjustment, you can compensate for a poor or 'peaky' subwoofer response, improve the low-end extension in a speaker that rolls off earlier than you'd like, and even reduce a subwoofer driver's cone travel (and therefore improve its power handling) without compromising its sound quality.

This last achievement is mostly thanks to the unit's relatively steep (-18dB/octave) subsonic filter, which greatly reduces inaudible and potentially damaging signals below 20Hz. When switched in, it can literally save a driver from flapping itself to death — particularly when a very low-frequency boost has been dialed up.

Regardless of any applied equalisation though, frequencies below around 20Hz can be bad news for drivers in ported enclosures, since the driver cone becomes 'unloaded' at frequencies below the port tuning point. The lack of a controlling force on the cone leads to excessive travel, and quickly leads to mechanical damage. This applies to the majority of subwoofers by the way, which are invariably of a bass-reflex or bandpass (vented) design.

Whether the processor is installed in its own box or perhaps inside an existing amplifier really depends on your own particular needs. The module itself is quite small, and you shouldn't have too much trouble finding a spot for it.

It can be driven from speaker- or line-level input signals, but the most likely way is probably from the mono subwoofer/effects output on the rear of a home theatre amplifier. Also, it really doesn't matter if it's driving a powered subwoofer that's already equipped with a low-pass filter, since the processor's own filter can be wound out to to its maximum frequency where it will have little effect.

Circuit details

The processor's circuit can be broken down into five cascaded stages, where each has quite a separate and defined job. Moving through the signal path as shown in the schematic diagram (Fig.1), these are; an input buffer/gain stage (IC1a), a variable low-pass filter (IC1b), the parametric equaliser (all of IC2), a fixed 20Hz high-pass filter (IC3a), and finally, an inverter/buffer output stage (IC3b). Three opamp chips are used in total (two dual LM833's and one TL074 quad), while all chips are powered from a common +/-15V supply rail.

Starting at the input stage, line level signals are applied directly to IC1a at R4, while speaker level signals (if that option is used) are first attenuated by R1 and R2 in conjunction with R3. Note that R3 has a value of 100k when the line level input is used, but must be a 1k resistor when using the speaker level inputs. In this way, the high level signals from an amplifier's speaker outputs are attenuated by around 20dB.

The input stage itself can be varied in gain over a range of +/-12dB by RV1, which is

placed across the opamp's inputs in a slightly unusual configuration. Here, the pot varies both the input attenuation (at R4) and the opamp's negative feedback (at R6), in an inverse relationship.

Note that the network values have been chosen for a maximum boost and cut of 12dB (a gain of 4 or 0.25), while the circuit is in balance with the pot in its centre position, resulting in a stage gain of one (0dB). Also, R5 is AC-coupled to ground to prevent DC voltage-induced pot noise, and C2 reduces the stage gain at above-audio frequencies.

IC1a's output is then applied directly to the following low-pass filter stage based on IC1b, which is a two-pole arrangement with a rolloff slope of -12dB per octave. The cut-off point can be varied from around 40Hz to 200Hz by the dual 50k pot RV2.

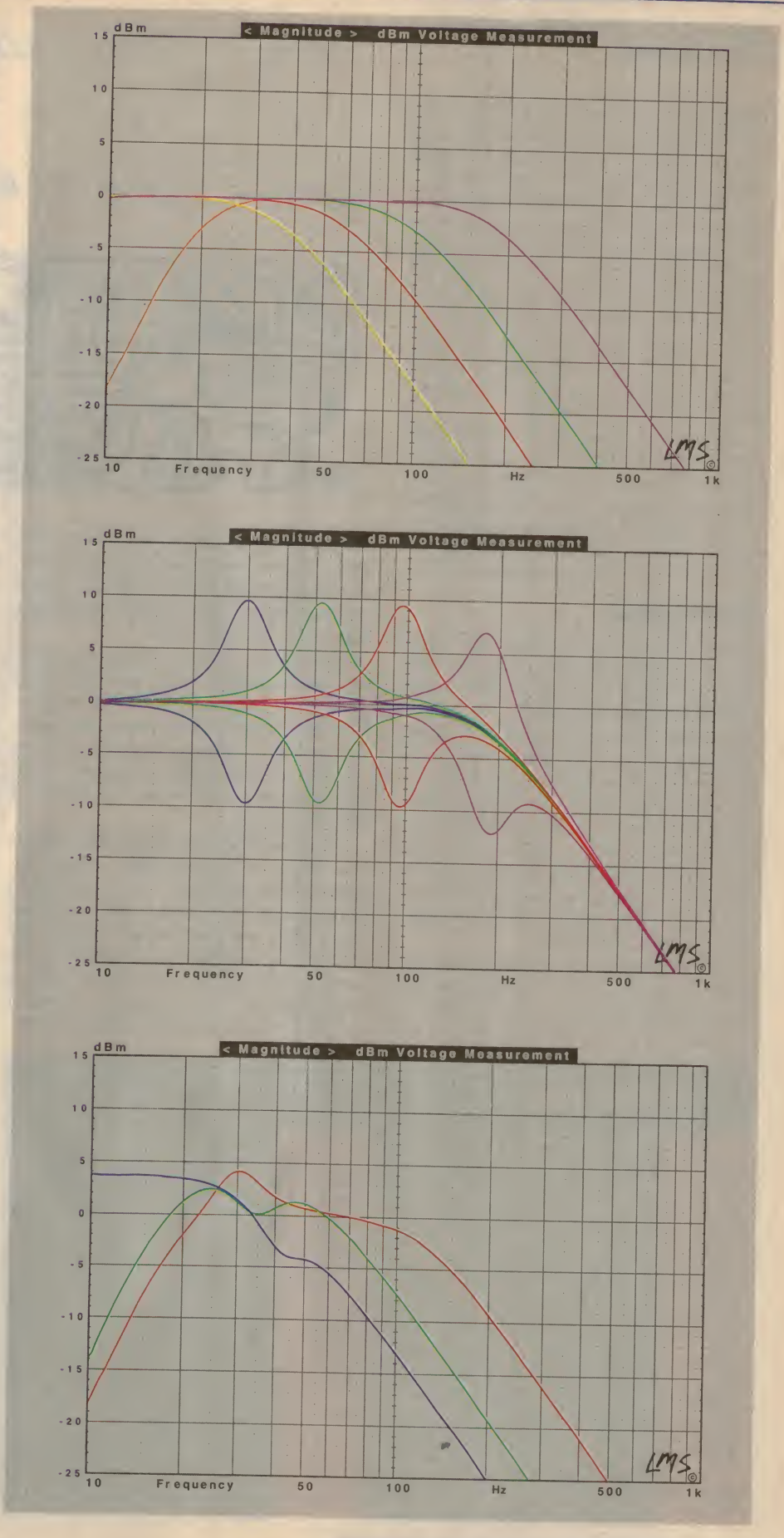
Next in line is the parametric equaliser stage based on a TL074 quad opamp, IC2. This is relatively standard state-variable filter circuit where multiple feedback paths are used around two single-pole filter stages (IC2b and IC2a). Both the positive and negative feedback networks create a controlled-Q bandpass output at IC2b (pin 7), which is then mixed with the input signal at the simple inverting/mixer stage IC2d.

The trick here is that the parametric's input stage (IC2d) is fed by the cut/boost pot RV4, which varies the take-off point between the input and output of IC2c. As this is an inverting opamp stage, the *phase* of the signal sent to the parametric is varied over a 180° range by RV4, causing the re-mixed bandpass signal subtract from or add to the original — or in effect, cut or boost that frequency area.

As before, a dual pot (RV3) is used to move the filter frequency to the desired point, C5 AC-couples the RV4's wiper to prevent noise, and C8 reduces the stage gain at above-audio frequencies. Along with the frequency, plus degree of cut and boost, the parametric filter's Q (or bandwidth, in effect) can also be controlled.

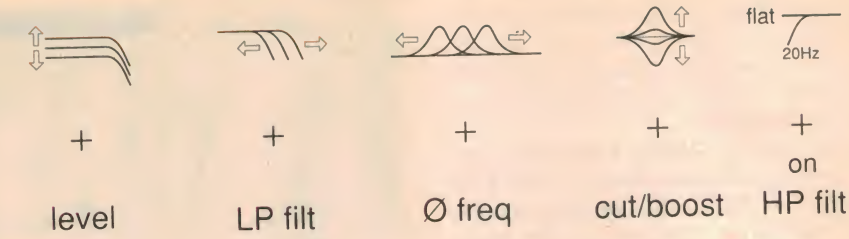
In our prototype this has been set to a value of around five by the 47k resistors R9 and R14, but the shape may be a little sharp for more gentle equalising jobs. These two resistors values can be varied as needed, where for example, a value of 27k would result in a Q value of about three. The equation Q = (Rq/R15 + 1)/3 can be used as a guide, where Rq is the value of R9 and R14, and R15 is 3.3k as shown.

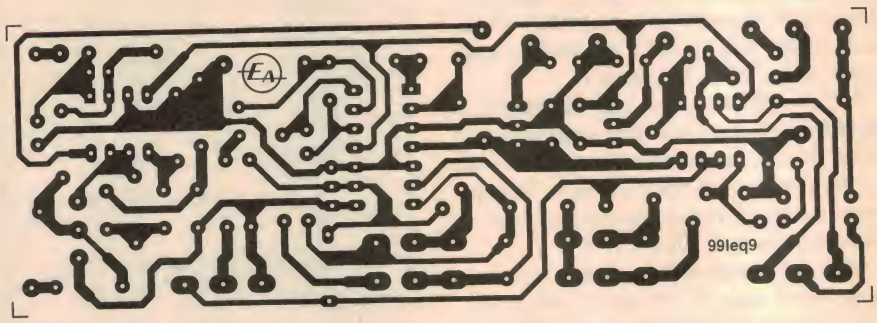
The equalised signal is next passed to a conventional three-pole high-pass filter



Right: Measured response plots from the Processor, showing (top to bottom) the HP (subsonic) and LP filters, the parametric equaliser, and how these (plus the level control) combine to a composite correction curve.

Right: The full-size PCB artwork plus a front panel design.





based on IC3a. This is arranged to quickly rolloff frequencies below about 20Hz, and can be bypassed by moving the following toggle switch (SW1) to the 'flat' position.

Finally, the selected output from SW1 is fed to the circuit's in-phase output (OUT1) via isolating resistor R25, plus the inverting stage IC3b. This stage is set to a gain of (minus) one by the combination of R23 and R24, and it's output is in turn passed to the inverse-phase output (OUT2) via R26. Again, C12 provides high-frequency bypassing, while R22 terminates the output stage during switch transitions.

The only remaining parts of the circuit are supply bypass capacitors C13 to C16, plus the three terminal regulators IC4 and IC5. These latter parts are not necessary if a well-regulated +/-15V supply is available from a host circuit or separate power supply, but if included, will need a DC source voltage of at least +/-17V.

Construction

Before beginning construction you really need to decide how and where the Bass Processor will be used, and therefore which optional components to install.

If you will be using an amplifier's speaker outputs to drive the processor, then you'll need to fit the associated 10k input resistors R1 and R2, and install a 1k resistor for R3. Make sure that you don't inadvertently fit a 100k resistor for R3 (as needed when a line level input is used), since this won't provide enough attenuation to guarantee the safety of IC1a — or for that matter, the power amplifier at the end of the chain.

The other point to decide is what DC power supply is at hand, if any. If you are installing the processor inside your main amplifier or the amp used to run a subwoofer, you should have a suitable split DC supply already available. The processor draws very little current, so you should just be able to just tap into the existing supply — this should lie somewhere between +/-12V and +/-15V.

Alternatively, you can fit the two three-terminal regulators and power the circuit from a raw DC supply of +/-17V or more. This unregulated supply could come from a power amp's rails via suitable dropping resistors, or simply from a dedicated transformer/rectifier combination that delivers a suitable voltage.

The physical arrangement for these options are shown in the component overlay diagrams, where the larger of the two (Fig.2) shows the unit configured to take a line-level input and a pre-regulated split supply. The smaller diagram (Fig. 3) has the components installed for speaker-level inputs and an unregulated DC supply source — note that R3 is shown as a 1k resistor, rather than 100k.

With the configuration decisions out of the way, the components can fitted to the PCB (coded 99leq9, measuring 115 x 40mm) while referring to the overlay diagrams as a guide. If you're using the close-tolerance multi-banded resistors, it may pay to check the value of each with a multimeter as they're installed. And as usual, pay close attention to the polarity of the ICs and electrolytic capacitors.

The only other points to note are that the pots should be pushed firmly down onto the board before soldering so that the shafts neatly line up, and filter on/off switch can be suspended on wire stalks (as in the prototype) so that it too matches that alignment.

Checking out

With the processor board completed you can now connect a DC supply and make a couple of initial tests — take care with the supply polarity here, and don't neglect to connect the 0V (common) line from the DC source. First check that the output of each stage is close to zero volts, and if not, quickly remove the power and re-check your work.

If all's well though, the next test is to try the circuit out with an audio input from a convenient music source, while monitoring the results at one of the outputs (OUT1 or OUT2). The controls should all make sense if the circuit is functioning correctly, and you should soon get a feel for how they can be used to tailor low-frequency signals.

If you're confronted by a stony silence at this point, you can quickly zero in on the area of concern by just progressively monitoring the output from each stage, starting with the input itself. By the way, as you're moving the monitor amp's input lead from stage to stage make sure that its earth or common point stays connected to the processor circuit's 0V line, otherwise you'll probably just hear a series of ungracious 100Hz blurts. ❖

Parts list

Resistors

R1,2	10k
R3	1k
R4,6,9,14	47k
R5	15k
R7,8,21	12k
R10,11, 16,17,18, 23,24	22k
R12,13	4.7k
R15	3.3k
R19	33k
R20	220k
R22	100k
R25,26	100 ohms
RV1,4	10k single pot, linear
RV2	50k dual pot, linear
RV3	25k dual pot, linear

Capacitors

C1,5	10uF bipolar electro
C2	82pF ceramic
C3,13,14	0.1uF MKT
C4	47nF MKT
C6,7,9, 10,11	0.18uF MKT
C8,12	150pF ceramic
C15,16	10uF 25V electro

Semiconductors

IC1,3	LM833 dual opamp
IC2	TL074 quad FET opamp
IC4	7915 -15V regulator (optional)
IC5	7815 +15V regulator (optional)

Switches

SW1	SPDT mini toggle

Miscellaneous

PCB coded 99leq9, 115 x 40mm; four small knobs, PCB pins.

INFORMATION CENTRE

BY PETER PHILLIPS

Electronic car rust prevention devices — do they work?

The topic this month is electronic car rust prevention systems. We look at typical methods, in particular at the capacitive coupling and cathodic techniques, with a few words about other less effective systems. So make up your own mind as we explore a topic that will hopefully interest a lot of readers.

In the June column I presented two letters about electronic rust prevention (ERP) devices in motor vehicles. The first letter suggested that *EA* might consider developing an ERP project, and briefly described a commercial ERP device called the Counteract. The second letter sought information about another commercial ERP device called the Body Gard. My response was to neither support nor bag these devices, given a similar experience some two years ago with an electronic device called the Pest Free, which is claimed to rid the average home of insects.

Therefore, as my knowledge of ERP devices is limited, I decided to ask readers, including ERP manufacturers, for more information. I've since received a number of letters from readers, and have also been contacted by a company in Queensland (Electronic Rust Prevention Systems Australia, or E.R.P.S) that manufactures a device called the ERPACS. So it's timely to discuss these devices, although I'm sure there will be scepticism amongst our readers. This is evidenced by the following letter, which is from a reader who is clearly not convinced about the Pest Free, and who is therefore unlikely to be convinced about an electronic rust prevention device.

Anecdotal evidence!

It's a pity you had to prematurely retreat on the Pest Free device, due to 'considerable anecdotes'. Sceptics understand what the word 'anecdote' is code for, but I don't know if everyone else does! We should never be afraid to be so open-minded that our brains fall out and dribble lightly on our feet. Instead, we should be amazed that the device can drive away some of the planet's hardiest and most adaptable species, and yet be safely compatible with sensitive new age human biology.

We should also be amazed that none of the major pest control companies have made an acquisitive motion. Pest Free now has evidence conducted by confidential researchers in a confidential university! Enough said. However the ACCC has apparently opened a preliminary investigation into the Pest Free device (says the Newcastle Herald).

To publicly admit that your Pest Free device doesn't work is to admit that your premises are still filled with vermin. So anecdotal evidence abounds. An article has been written on Pest Free by Colin Keay, astronomer and head of the Hunter Skeptics. See 'The Skeptic', Autumn 1999 or visit ***www.skeptics.com.au.*** (Chris Johnson-Walker, Whiporie, NSW)

If you read my comments in the April 1997 issue Chris, you'll see there was more than just 'anecdotal evidence' to support the claims made about the Pest Free. I recall getting a bundle of some 50 letters from 'satisfied users' from various parts of the world, sent to me by Pest Free, along with details of research being conducted by a local university. I also received a number of very supportive letters from readers about this device.

So, as far as I'm concerned, there appears to be evidence to support the company's claims about the Pest Free. Whether it works in all cases is difficult to say, but my point is, there are a lot of people out there who swear by the Pest Free device. And if we are to ignore anecdotal evidence, then we must ignore all those people who claim the device works.

Now to another letter, this time from a reader who is somewhat mistrustful of an electronic device that prevents rust. It asks a number of questions, which I hope to be able to answer further in the column.

ERP questions

I admit I know nothing about ERP devices, but your correspondents provided some clues which I would like to comment on. Summarising, it would seem that rust prevention devices have the following features:

(1) negative pulses applied to body of vehicle, (2) no external connections except via the battery leads, (3) capacitive coupling (to what?), (4) a field (negative?) of ions (of oxygen?) produced over metal surface of vehicle, and (5) a layer of stable (?) ferric oxide formed on all exposed surfaces. Let's see what we can deduce from these clues.

(1) Negative (or positive) pulses can't be applied in isolation. A flow of negative charge to the body of the vehicle in order to produce those pulses implies that an equal and opposite charge (return current) must flow somewhere else (thus forming a closed current loop).

(2) Since there is (presumably) no direct connection with any object (either the vehicle or the earth) except via the battery leads or the enclosure for the device (if of metal), we might conclude that energy is coupled to the vehicle body either capacitively or inductively. Inductive coupling would tend to generate currents rather than significant voltages. Therefore capacitive rather than inductive coupling is implied (which is consistent with what is claimed).

(3) What, then, is the significance of 'capacitive coupling'? Is it intended to produce a pulsating electric potential at the vehicle body with respect to earth? In that case a return path (presumably via capacitance between earth and a metal plate in the device, for example) must be provided to complete the current loop. That would not, however, appear to be a very efficient arrangement.

(4) What kind of ions are being produced? Presumably oxygen ions are meant to be produced (ferric ions are positively charged so they would not be produced by negative pulses). In any case, in the absence of an

electrolyte (such as water mixed with an ionisable substance). I would imagine that ionisation (of oxygen in air) would require a substantial peak pulse voltage level.

If ionisation occurs on the surface of the vehicle's chassis, then that would imply a high (pulsed) electrical potential gradient surrounding the vehicle body. I wonder how that would affect the physiology of its human occupants? On the other hand, if ionisation occurs inside the device, then how would the ions be distributed over the entire vehicle body in order to provide the desired effect? And, how would the human occupants react to those ions? Incidentally, doesn't ionisation of air result in ozone, a poisonous substance?

(5) The idea of forming a 'stabilising' layer of ferric oxide is not, of itself, new. Like aluminium, certain grades of steel form such a layer naturally in air, which inhibits further rusting. This process does not, as far as I know, require the application of electric potentials. The main drawback, in the case of steel, appears to be that the thin layer of ferric oxide is unsightly.

A point not raised in your correspondents' letters is that of the EMI likely to be produced by the devices in question. EMC regulations demand strict control of emissions, particularly above 150kHz. Are the emissions from these devices controlled to present EMC standards and how would these devices affect radio reception, for example, inside a vehicle?

There are a lot of unanswered questions in my mind about these devices, hence my scepticism. The fact that I can't see how these devices work as claimed does not mean they don't. However, until I'm convinced otherwise, I don't think I'll be forking out $600 (or whatever), thank you very much. (Herman Nacinovitch, Gulgong, NSW)

THIS MONTH'S WINNER!

Thanks Herman for asking these questions, as I'm sure they reflect what a lot of readers might be thinking. I'll attempt to answer them as we proceed with this look at ERP devices. Perhaps a good place to start is with a brief rundown on a popular and proven method of rust prevention: the cathodic method.

Cathodic rust prevention

Although I have a limited experience with electronics, I have discussed electronic rust protection systems with a friend who swears by them, and have discovered that they work on a principle that is not entirely 'electronic'.

His system works with a type of electron exchange. The correct name for 'corrosion' is 'oxidation', or a loss of electrons by the atoms in a metal, which make it able to combine with another substance such as oxygen.

Fig.2: This shot shows the ERPACS rust prevention device. The coupling plate is on the left, the inverter on the right

An electronic rust preventer simply stops the loss of electrons in a car body, and therefore prevents the formation of iron oxide (rust). It does this is in similar way to that of galvanising steel. A large block (or up to six blocks for a very large vehicle) of a highly reactive metal (such as sodium) is attached to the body at a central location.

Put simply, when a more reactive metal is placed next to a less reactive one, as the less reactive metal loses its electrons, the more reactive metal 'sacrifices' its electrons to the less reactive metal. The nett result is that the less reactive metal (the car body in this case) is left untouched, while the more reactive metal (the block of sodium) slowly disappears. This is the method used to galvanise steel (with zinc and iron). There is, however another system at work.

As the block of sodium is losing electrons, it slowly disappears. However, there is one place in a car that has an excess of electrons — the battery. By connecting the block to the car battery, the sodium block could last for many years as its electrons are replaced from the battery. This system is used extensively by the military in trucks and tanks etc, as its protection is greater than 90%, and only needs replacing every ten years or so, as opposed to paint-based rust prevention systems which only protect about 60% and need to be redone every 4-5 years. (Frith Foottit, by email)

Thanks for this information Frith. There are two types of technology typically used in rust prevention: cathodic and capacitive coupling. Both methods achieve the same end result — to replace electrons lost by the metal being protected. Note that is does not, as Herman suggests, cover the metal with a thin layer of ferric oxide.

We look further at cathodic protection later, but let's turn now to the capacitive coupling method used by the Counteract and the ERPACS. Here's what the manufacturer of the ERPACS system has to say:

The ERPACS device

First up, let me point out that my role is to present information, not opinions, especially as I don't have any experience with ERP devices.

The company in question (E.R.P.S. Australia) is based in the Gold Coast and produces a rust prevention product that was originally based on the Counteract device. The son of the inventor of the Counteract initially worked with E.R.P.S., but the company has now further developed the device to a point where the patent office regards the E.R.P.S. device as being sufficiently different from the Counteract to allow it to be patented. However, both devices use the capacitive coupling technique, with the E.R.P.S. system claimed to be more compatible with Australian conditions.

As you would expect, E.R.P.S. has a lot to say about other devices on the market. According to the company: *"It is unfortunate that there are a number of 'con-artists' in the industry that try to market ineffective 'black boxes' at high prices. While the ERPACS system is the most effective corrosion and electrolysis retarding method available today, it is not 100% effective in all conditions. There is no 'miracle cure' and commonsense dictates that it is not viable to protect structures that are 'too far gone'."*

I understand that the Body Gard is priced at around $700, while the ERPACS costs $395 or so. The Counteract is also more costly than the ERPACS. I have no details of other ERP devices. So, given it's the cheapest, does the ERPACS work?

The company supplied me with two testimonials from users, and a promotional video that includes two people (one from a surf lifesaving club, the other from a fishing company) who claim the product has worked well for them. One of the letters is from a company that carts fertiliser, and says: *"We started with only one rust proofing unit on our work ute, in 1998. We were so amazed with the results that we installed a unit on one of our eight tonne trucks. Once again the*

results were astounding..."

OK, it's anecdotal evidence, so perhaps we should now look at how the ERPACS system works, to give us technical types more to go on.

Capacitive coupling systems

Again I'm quoting from literature sent to me by E.R.P.S. I've selected (and edited) a few extracts, which I hope will give you an idea of the principle of operation. The document discusses three ways to protect metal against rust: sealing the surface (painting), cathodic (sacrificial anode), capacitive induction, and also looks briefly at the 'impressed current' technique.

Cathodic protection has proved reasonably effective in retarding corrosion in aqueous environments. With this method, anodes of a more 'reactive' metal compared to steel, such as blocks of zinc, are attached at regular intervals to the steel to be protected. Zinc gives up its electrons in the corrosion process very readily, which 'enrich' the steel, discouraging it from giving up its electrons, thus retarding the corrosion process.

However for this system to work, an external conducting medium is required to complete the electrical circuit. Constant moisture is necessary over the whole structure being protected, which is fine for bridge pylons in rivers, or pipes laid in damp soil. However, from observations of dredging barges employing cathodic protection, rust is not prevented above the water line, with severe rust penetration usually obvious about 50-75mm above the waterline where waves have lapped the steel.

Butting in, if you read Frith Foottit's letter again, you'll notice there's no mention of the need for moisture. To find out if moisture is essential, I searched for cathodic protection on my Encyclopedia Britannica CD-ROM and found the following:

Protective films on steel are susceptible to being broken by flying stones or other sharp objects. This is especially true on those parts of an automobile that are close to the road. Protection of a small exposed area of steel can be maintained if a metal that has a greater tendency than steel to give up electrons in water is attached to the surface. In this way, when the protective barrier is broken, the more reactive metal is corroded preferentially, and the steel is given 'galvanic' protection.

Notice the reference to water, which I assume means it (or moisture) is required. Perhaps there are other ways to ensure an electron flow with a cathodic system, or perhaps Frith didn't mention this aspect. Continuing now with the E.R.P.S. document:

Attempts have been made to simulate cathodic protection in air by the 'impressed current' technique; that is passing a current through the metal. Unfortunately this method can be dangerous and it seems that protection only appears within 1-2cm of the point of contact.

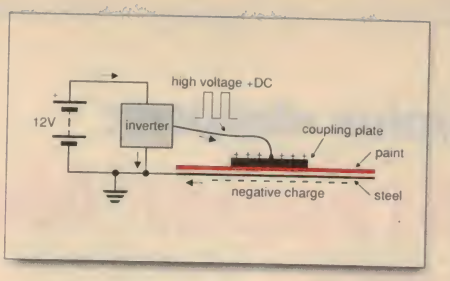


Fig.1: Block diagram of a capacitive coupling electronic rust prevention system.

Capacitive coupling. This method of protection seems to emulate the effect of cathodic protection in air, by inducing an electrostatic field on the surface of the metal to be protected. By coating the surface of the steel with a non-conductive paint, and fixing a plate to the surface of the coating, a capacitor is formed. (See Fig.1)

If a positive voltage is applied to the plate, with the coating acting as a dielectric, a negative charge is induced onto the surface of the steel. Furthermore the field is spread at the coating/steel interface for a considerable distance over time. The field does not spread through the steel, it only appears on the surface, so a solid block, if completely coated, would have the field spread over all surfaces via the edges. Alternatively, a hollow block with no openings would not be protected on the inside.

Field spread and charge density are obviously critical to the rust retarding process. Our observations are that more coupling points are needed for hostile environments. Unfortunately, it's not practical to measure the field strength, so observing its effect is the only way to determine the number of coupling points needed for a particular application.

Conclusion

As we're running out of space, I need to wind up the discussion with a few observations. Returning to Herman's letter, the ERPACS device has all the required EMC approvals. Furthermore, I doubt that the system produces enough ions to cause a dangerous, or even a perceptible level of ozone.

As the photo shows, it comprises a small box and a coupling pad. The box houses an inverter that produces around 600V DC pulsed at 10kHz, which is connected to a coupling pad attached to the painted metal surface of the vehicle. Increased protection is claimed if more pads are used, required in a four wheel drive operating in salt water. The power consumption of the device is "about that required to operate the vehicle's digital clock".

Fig.1 shows the electrical connections and directions of current flow. It doesn't show some aspects that are proprietary to E.R.P.S., but it should give you the idea of how the capacitive coupling system works. There's a lot more that can be said, but for what it's worth, after reading all the literature and discussing the topic with the proprietor of E.R.P.S., I believe that the claims being made about the ERPACS can be supported. If you want to know more, phone E.R.P.S. on 1800 332 899.

What??

This month's question comes from David Jones (Lethbridge Park, NSW), who points out that he solved the problem with a simple spreadsheet rather than mathematically. All you have to do is to find the current flowing in the circuit.

Answer to August

The resistance is 122 ohms, which can be found by using delta/star and star/delta transformations. There are no doubt other methods to find the answer.

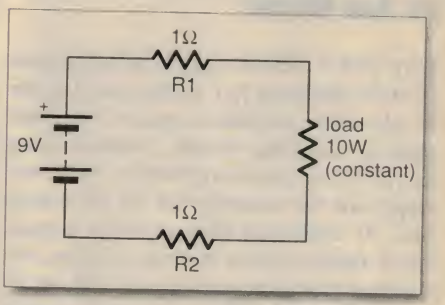


Fig.3: Find the current flowing in the circuit.

Also, my apologies for the ommision in the diagram for the July What?? question. The op-amp's output voltage should have been shown as 8V. Armed with this knowledge, you would have no doubt come up with the answer printed in the August issue...❖

Construction Project

Great for driving surplus steppers:

Improved Stepper Motor Driver using MOSFETs

In the July article on building a low cost PC controlled X-Y plotter using parts salvaged from the 'distress sale' printers from Oatley Electronics, we mentioned that Oatley had also developed a new improved high-efficiency stepper motor translator/drive module for this and similar applications. Here are full details of the new module, as promised.

BY JIM ROWE

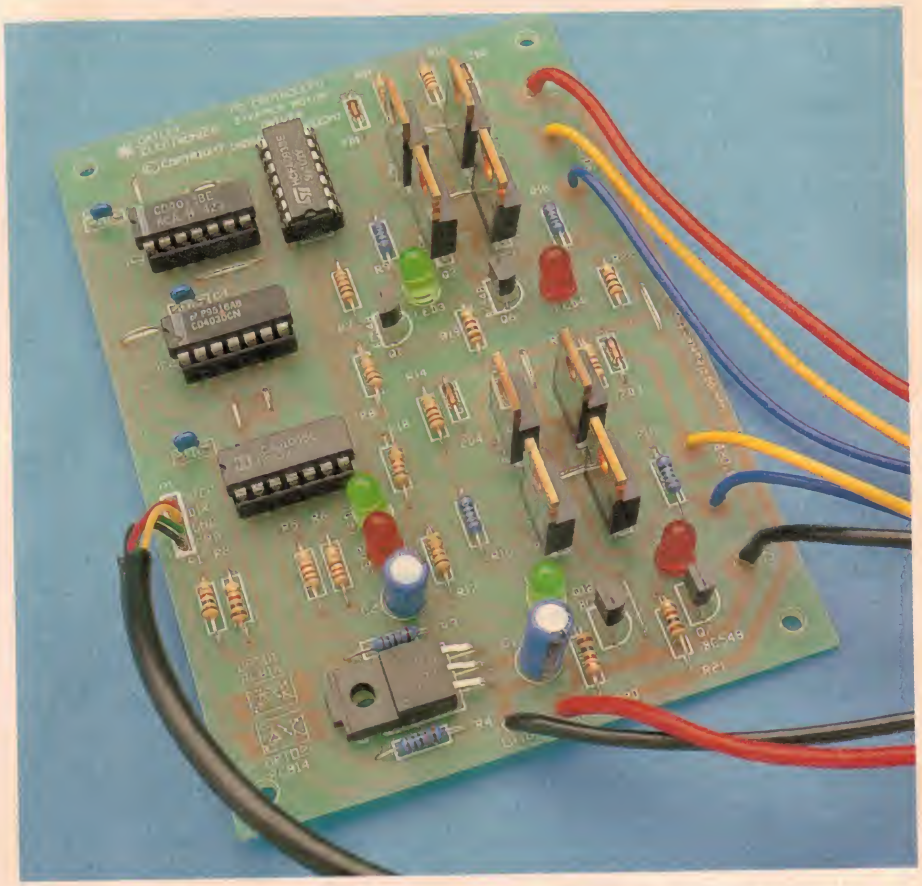
IF YOU LOOKED closely at the pictures of the prototype X-Y plotter shown in the July article, you'd have seen two small and identical electronics boards, mounted along the rear of the baseboard between the power supply and the connector for the PC printer lead. As explained, these were the stepper motor translator/driver modules, used to control the plotter's stepper motors in response to commands from software (typically DANCAD) running on the PC.

One of these translator/driver modules is needed to drive each stepper motor, so you need two in the case of an X-Y plotter or three if you're building a three-axis engraving or milling machine.

Luckily the new module design that Oatley has developed is compact, easy to build, low in price and also very efficient. Thanks to the use of low on-resistance power MOSFETs in the output switching circuit, it will happily run even one of the larger steppers from Oatley's surplus 'German' printers from the 5V supply from the same printers, and without any heatsinks on the output devices...

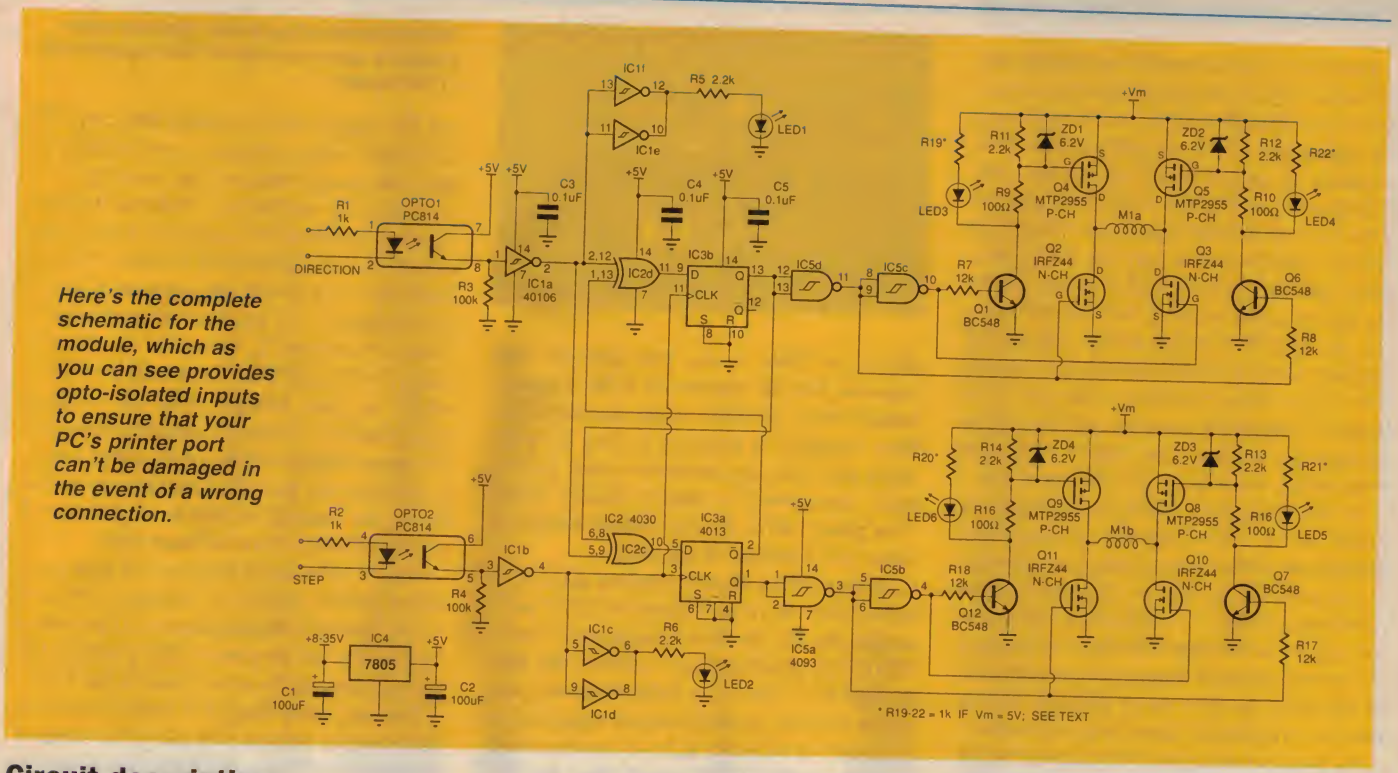
But let's start at the beginning. What exactly *is* a stepper motor translator/driver module? Well, it's a module with circuitry capable of taking the relatively high-level 'step' and 'direction' commands coming from the PC software, and generating the correct sequence of current pulses to make the stepper motor behave accordingly.

The reason why we need such circuitry is that stepper motors are rather like simplified conventional DC motors, without a commutator or brushes. The most common type generally has a multi-pole permanent magnet rotor, and a multi-pole stator with two or more windings. This means that they're incapable of rotating through more than one tiny angular 'step' unless the current in the stator windings is switched in a cyclic sequence — roughly duplicating the job done by the brushes and commutator of a conventional DC motor.



There are various ways of switching the current through the windings, and various circuit configurations used to perform the switching. We needn't go into too much detail about this here, because the module we're going to discuss does the job in one of the most standard and effective ways: a so-called 'H-bridge' of switching transistors controlling the current in each of the two motor windings, driven in turn by a simple 'state machine' circuit which generates a sequence of control pulses in response to commands from the PC software.

The main thing to bear in mind is that by using a module which incorporates this kind of 'translator' circuitry as well as the actual motor current switching, we are able to free the PC software from the task of worrying about all the 'fine details' of getting the stepper motor to rotate. All the software now needs to do is issue two simple commands each time it wants that motor to turn through one of its angular steps: a short 'step' pulse, plus a 'direction' control signal which tells the translator circuitry whether the step is to be made in a clockwise or anticlockwise direction.



Here's the complete schematic for the module, which as you can see provides opto-isolated inputs to ensure that your PC's printer port can't be damaged in the event of a wrong connection.

Circuit description

Now let's look at the schematic for the module, to see how this is all done. It's probably easier to follow if we work backwards, starting from the motor windings and their switching circuits.

The two windings of our stepper motor are shown in the schematic as M1a and M1b. As you can see, each end of each winding is connected to the junction of the drains of two power MOSFETs: a P-channel MTP2955 connecting to the positive supply rail (+Vm), and an N-channel IRFZ44 connecting to ground. So each winding and its four switching MOSFETs are connected in an 'H-bridge' configuration, with the windings themselves forming the horizontal 'bars' of each H.

Now the idea of this configuration is that simply by turning on the right combination of switching transistors, we are effectively able to connect each motor across the single DC power rail Vm, *either way around* — so that current flows through it either one way, or the other. For example if we turn on Q3 and Q4, but leave Q2 and Q5 off, current will flow through winding M1a from left to right; but if instead we turn Q3 and Q4 off, and turn on Q2 and Q5 instead, the current will reverse and flow from right to left.

Of course we have to be careful never to turn on Q2 and Q4 together, or Q3 and Q5 together, as this would put a short-circuit directly across the supply. However the circuit is designed to ensure that this can never happen, as we'll see shortly.

Bipolar transistors Q1 and Q6 (also Q12 and Q7 in the lower bridge circuit) are used as level-changing buffers, to drive the upper P-channel MOSFETs in each arm of the bridges. For example to turn on Q4, which has its source tied to +Vm, we need to apply a negative voltage to the gate. This is done by turning on Q1, which draws current through R9 and R11, and provides Q4 with the necessary forward gate drive.

So essentially turning on any of the four bipolar transistors also turns on its associated P-channel MOSFET. And as you can hopefully see, the base drive for each bipolar transistor is tied to the gate of the N-channel transistor in the lower arm of the opposite side of each H-bridge. For example Q1 turns on at the same time as Q3, and turns on Q4 as well — sending current through M1a in the left-to-right direction.

Similarly Q6 turns on at the same time as Q2, and also turns on Q5 as well — in this case sending current through M1b in the reverse direction, from right to left.

Note that when Q1 and Q6 conduct, they are also arranged to draw current through LEDs 3 and 4 respectively. These are provided mainly so you can see which way the current is flowing through that motor winding.

But how do we make sure that these two different conditions, of current flowing through M1a in either one direction or the other, can never occur at the same time? That's the purpose of gate IC5c (and IC5b in the lower bridge), connected as an inverter. As you can see Q1 and Q3 are driven from the output of this inverter, while Q2 and Q6 are driven from its input (or strictly, the output of IC5d, which drives its input). Since the output and input of this inverter will always be opposite in logic level, this means that one pair of transistors can never be conducting at the same time as the other pair.

Parts list

Resistors

All 0.25W 5%:	
R1,2	1k
R3,4	100k
R5,6,11, 12,13,14	2.2k
R7,8,17,18	12k
R9,10, 15,16	100 ohms
R19,20, 21,22	1k (but see text)

Capacitors

C1,2	100uF 25VW RB electro
C3,4,5	0.1uF monolythic or MKT

Semiconductors

IC1	40106 hex Schmitt inverter
IC2	4030 quad ex-OR gate
IC3	4013 dual D flipflop
IC4	7805 +5V regulator (see text)
IC5	4093 quad Schmitt NAND gate
OPTO1,2	PC814 optocoupler
Q1,6,7,12	BC548 NPN transistor
Q2,3,10,11	N-channel power MOSFET
Q4,5,8,9	P-channel power MOSFET
ZD1,2,3,4	6.2V zener 400mW
LED1,3,6	5mm green LED
LED2,4,5	5mm red LED

Miscellaneous

PCB, 122 x 86mm; 4 x 14-pin DIL sockets; hookup wire for off-board connections; solder, etc.

NOTE: Kits for this project are available from Oatley Electronics, PO Box 89, Oatley NSW 2223; phone (02) 9584 3563, fax (02) 9584 3561 or visit their website (www.oatleyelectronics.com). The kit is priced at $45 plus $6 for packing and postage within Australia.

From this you can hopefully see that the control signal input of the upper H-bridge is therefore at pins 8 and 9 of IC5c, or if you prefer at the output (pin 11) of inverting buffer IC5d. Similarly the control signal input for the lower H-bridge is pins 5 and 6 of IC5b, or pin 3 of IC5a. In each case the logic level at this point directly controls which way the bridge conducts, and direction in which it passes current through its motor winding. So when pin 11 is low, pin 10 of IC5c is high and Q1, Q4 and Q3 conduct, sending current through the winding from left to right; conversely when pin 11 is high, Q2, Q6 and Q5 conduct, sending current through the winding from right to left. The lower bridge works in exactly the same way.

At this stage, then, we have our basic H-bridge motor driver, capable of controlling the currents in the motor windings in response to low-power logic signals. It's the job of the remaining circuiry to manipulate these control signals in the right sequences, to produce our repetitive motor stepping in one direction or the other. So now we're going to look at how the 'translating' function is performed.

As you can see gates IC5d and IC5a are simply connected as inverters — essentially to provide some buffering and make sure that the control signals fed to the output bridges switch between the high and low logic levels as quickly and cleanly as possible.

The actual generation of the motor stepping sequences is controlled by D-type flipflops IC3a and IC3b, plus ex-OR gates IC2c and IC2d, which together form a very simple 'state machine'. Because of the way the two flipflops are interconnected via IC2c and IC2d, their outputs can only change levels in one of two sequences — one the mirror image of the other — in response to clock pulses fed to their CLK inputs (pins 3 and 11) from the output of inverter IC1b. And which of the two sequences applies at any time depends on the logic level applied to the 'other inputs' of IC2c and IC2d, from the output of inverter IC1a.

This isn't as complex as it probably sounds. The trick is that ex-OR gates are very handy elements: because of the way they work, one of their inputs can be used to control whether they perform logic inversion on the other input or not; in other words, whether they act as an inverter or a non-inverting buffer.

In this case, when the control signal applied to input pins 2, 12, 5 and 9 (the inputs of the two unused gates in IC2 are connected in parallel, rather than left floating) from IC1a is at logic low, IC2c and IC2d act as non-inverting buffers; conversely when the control signal is at logic high, they become inverters. It's this reversal of function that we use to switch between one or other of the sequences available from IC3a and IC3b.

We don't have the space here to analyse this in great detail, but if you want to check it out for yourself the two sequences are shown in Table 1. As you can see, one sequence has the outputs of IC3a 'lagging' behind those of IC3b, while the other has them 'leading' in terms of cycling between highs and lows on successive clock pulses. Both correspond to what's usually called 'two phase' drive for the stepper motor, in either one direction or the other.

This close-up shows how the two opto-couplers are mounted on the copper side of the board.

As you can see, the clock pulses fed to IC3a and IC3b by IC1b are simply the STEP pulses from the PC, fed first through opto-coupler OPTO2 (to provide safety isolation) and then through IC1b itself — a Schmitt inverter acting as a buffer. And the control signal fed to IC2c and IC2d from IC1a is nothing other than the DIRECTION signal from the PC, again fed through opto-coupler OPTO1 and IC1a as an inverting buffer. So it's really quite easy for the software in the PC to make the stepper move in the one direction or the other, simply by setting the DIRECTION line to the correct logic level and sending one or more pulses down the STEP line.

Inverters IC1c-f play no important role in this basic operation, but are simply connected in pairs as buffers, driving indicator LEDs 1 and 2 via current limiting resistors R5 and R6. As a result LED1 gives an indication of the current status of the DIRECTION control signal from the PC, while LED2 blinks to show the arrival of STEP pulses from the PC.

That's about it for circuit operation, apart from the power supply arrangements. As you can see the low-level logic circuitry all works from a +5V rail, while the output H-bridges operate from +Vm, which can be virtually any DC supply with a voltage between +5V and +35V, with sufficient current capacity to drive the stepper motor(s) you're using.

As you can see Oatley's designer has provided an on-board 5V regulator, IC4, which can derive a regulated and filtered +5V rail from the +Vm power rail, providing Vm is above about 7 - 8V (to give the regulator sufficient 'headroom'). However if you are using a +5V supply for the motors as well — which is quite feasible with the steppers from Oatley's 'German' printers (and also the power supplies from them), there's really no need for the +5V regulator. In fact it has to be omitted in this case, because it would definitely have no headroom.

So IC4 is basically only used if you use a motor power supply of between +8V and +35V, to drive different steppers. If you use a +5V supply for the motors, IC4 is simply left out and replaced by a wire link on the PCB.

The only other thing that varies according to the supply voltage you use is the value of resistors R19-22, in series with the H-bridge indicator LEDs. These can be 1k if you're using a power supply between 5V and 12V, but need to be increased in value for higher voltages. For example 2.2k would be appropriate for supply voltages from 12V to 24V.

Table 1

'Two-phase' step sequences

A. Direction Input = 1, IC2a(2) = L
(IC2c,d non inverting)

STEP	IC3b(13)	IC3a(1)
0	0	0
1	1	0
2	1	1
3	0	1
(4)	0	0

B. Direction Input = 0, IC2a(2) = H
(IC2c,d inverting)

STEP	IC3b(13)	IC3a(1)
0	0	0
1	0	1
2	1	1
3	1	0
(4)	0	0

Construction

As you can see from the photos and overlay diagram, the circuitry for the module is all fitted on a compact single-sided PCB measuring 122 x 86mm. All of the components are mounted on the top of the board except the two input isolation opto-couplers, which mount underneath on the copper side.

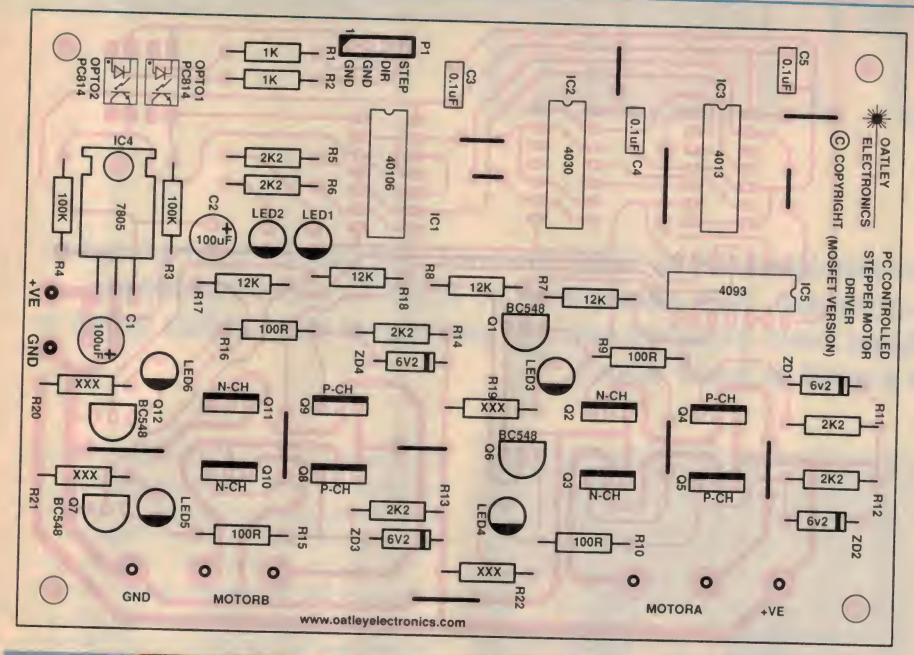
Assembly is quite straightforward, but it's a good idea to check the copper side of the PCB before fitting any components, to make sure there are no solder bridges or damaged tracks.

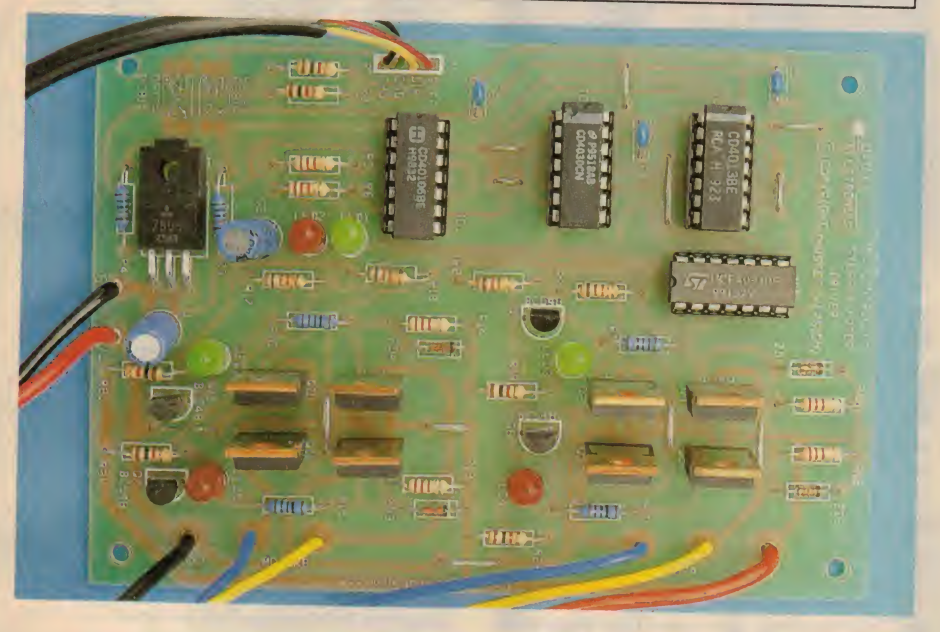
It's then wise to fit the small wire liks first, in case you forget these later. There are 12 in all, so make sure you don't miss any.

Next it's a good idea to fit the low-profile resistors and diodes, taking special care with the latter to make sure they're orientated correctly as per the overlay diagram. Then you can fit the LEDs, making sure these are also orientated correctly. They can be fitted with their bodies quite near to the PCB, for better physical support. Make sure too that you fit the green LEDs in positions 1, 3 and 6, and the red LEDs in the other three positions.

Now you can fit the two electrolytics C1 and C2, observing the correct polarity, and also the remaining bypass caps C3-5.

It would be a good idea to fit the opto-couplers under the board next, making sure they're fitted with their 'dot' (pin 1) side towards the top edge of the board — i.e.,





Use the overlay diagram at left as a guide to wiring the PCB -- and note that the photo (and our lead shot) both show a PCB with the DC power connections near C1 transposed.

away from regulator IC4, when it's used.

Now you can fit the sockets for the logic ICs, making sure these are orientated as per the overlay diagram, and perhaps regulator IC4 if you're going to be using it. Otherwise, fit a small extra link to the PCB, using the two outer holes normally used for the regulator pins.

At this stage you're ready for the small bipolar transistors, which as you'll see from the overlay diagram are all fitted with their 'flats' towards the 'top' of the board — i.e., the side nearest to the opto-couplers. They should be fitted with their bodies about 3 - 4mm from the board; any closer and their leads may be strained.

Now you're ready to fit the power MOSFETs, but here I'd suggest that you fit only the N-channel devices first. These are the devices marked 'IRFZ44N', and as you can see from the overlay diagram these are all fitted into the left-hand position of each horizontal row: Q10, Q11, Q2 and Q3. They all mount with their metal heatsink tabs towards the 'top' of the board (as do the P-channel devices, when they're fitted).

Checkout time

Before going any further, I suggest that you carefully fit the various logic ICs into their correct sockets, and hook up the board's main power input to a suitable DC power supply — say the 5V supply salvaged from the German printer, if that's what you'll be using.

Please note, though, that one batch of PC boards supplied with Oatley's kits has the polarity marked wrongly for the DC power input. As shown on our overlay diagram, the positive power input goes to the terminal nearest regulator IC4 — NOT the other way around, even if this is shown on the PCB silk screening.

Now connect up the DC power supply, still with the P-channel MOSFETs not fitted, and no connections to the PC or a stepper motor. You should find that LEDs 1 and 2 should remain off, while ONLY ONE of each pair of output bridge LEDs should glow: either LED3 *or* LED4 (definitely not both), and either LED5 or LED6.

If you now take a small insulated cliplead, hooked to the +5V rail at one end, you should be able to make either LED1 or LED2 glow by touching its other end to the 'top' end of resistors R3 or R4 respectively. (These are the ends nearest the opto-couplers). Touching the lead repeatedly to the top end of R4 should also the output LEDs of each bridge to 'swap glow', so that although only one of each bridge's pair is on at any one time, they exchange roles in a cyclic way.

If everything works as described, your module is likely to be wired correctly to this point, and it should be safe to complete assembly. So remove the power again, and then carefully fit the four P-channel power MOSFETs to the remaining 'right-hand' positions on the board — marked Q4, Q5, Q8 and Q9.

Your translator/driver modules should now be complete, and ready to hook up to your stepper motor and PC printer port.

For a typical four-wire stepper motor, the two windings are simply connected to the module as M1a and M1b; i.e., to the PCB terminals marked 'Motor A' and 'Motor B'. Steppers with five or six wires generally still have two windings, but with either separate centre taps or a shared centre tap. In these cases, use a multimeter to identify the centre tap(s) via resistance measurements, and then ignore them.

Motors with eight wires are a bit trickier; you have to connect each pair of opposing windings so they're in series, and just use the outside ends of each. Identifying which pairs are magnetically opposing can be tricky, though, as can connecting them in series with the right polarity. It's probably best done by trial and error.

If you're going to be driving the module(s) from a PC running DANCAD, the GND side of the two inputs (DIRECTION and STEP) connects to the common earth connection on the parallel printer port (pins 19-30), while the active inputs connect to various data pins on the printer port. For example DANCAD sends its STEP signals out via data pins 2, 3, 4 and 5 (up to four modules), and its DIRECTION signals out via pins 6, 7, 8 and 9. So for your first module, they connect to pins 2 and 6 respectively.

For the basic X-Y plotter, Oatley's design notes give the overall connections if you need them.

Happy stepping! ❖

$10 WONDERS

27 - Door guard

This little home security device is not intended to raise the roof, but just to start bleeping if or when it detects something untoward. This allows it to be used for other purposes, such as telling you when the kiddies have escaped into the garden, or the cat has come in - things that the neighbours don't need to know about.

On the warm evenings we get in Western Australia we love to sit on the front porch and relish the cool breezes coming in from the Indian Ocean. Also we like to leave all the sliding doors open on the other side of the house so that the breezes blow through the house, cooling it down during the evening.

The worry is that our flyscreens don't lock, so someone could walk in through the doors at the back of the house while we are blissfully enjoying an ice-cold Martini at the front. Unfortunately we don't have a dog, so lets make something similar!

How it works

The sensor is an infrared photodiode (D1, Fig.1). In this circuit (and just about all others you'll find) it is reverse-biased — that is its cathode (k) is at a higher voltage than its anode (a). Only a very small current is able to leak in the 'wrong' direction through the diode, and so under the illumination of a 75W bench light the current is in the region of only 40uA.

The leakage current is proportional to the amount of light falling on the sensor, and if we put a high-value resistor in series with it, the voltage developed across the resistor will be reasonably large. For example, 40uA flowing through a 100k resistor produces a 4V drop.

Many security devices operate on the basis of having a beam of light directed at the sensor. An intruder breaks this beam and the drop in light level triggers the circuit. This design can be triggered in this way, but the actual triggering operation is entirely different.

For a start, we don't need a lamp to produce the beam of light. We rely on any convenient source of light, such as a verandah lamp or a street light, or by day, sunlight coming in through an open window. The device is positioned so that the amount of light falling on the sensor varies when someone or something passes by. It need not even be a *reduction* in the light level - this circuit can be triggered by a person wearing light-coloured clothing who happens to cause more light to be reflected on to the sensor in passing.

The other feature of this circuit is that it isn't the absolute light level that triggers it. This is an important feature since many systems cease working, or trigger falsely if the ambient light level changes. This could happen with changes in the position of the Sun, especially in the early evening, or on cloudy days. The headlamps of passing cars at night may also cause light levels to change temporarily. On the whole, such changes are relatively slow and this design ignores them. It responds only to *rapid changes* of light resulting from people passing close by.

The reason it responds only to rapid changes is that the triggering section of the circuit is an opamp wired as a *differentiator*. The output of this amplifier at any instant is given by: $V_{out} = -RC \times dv_{in}/dt$

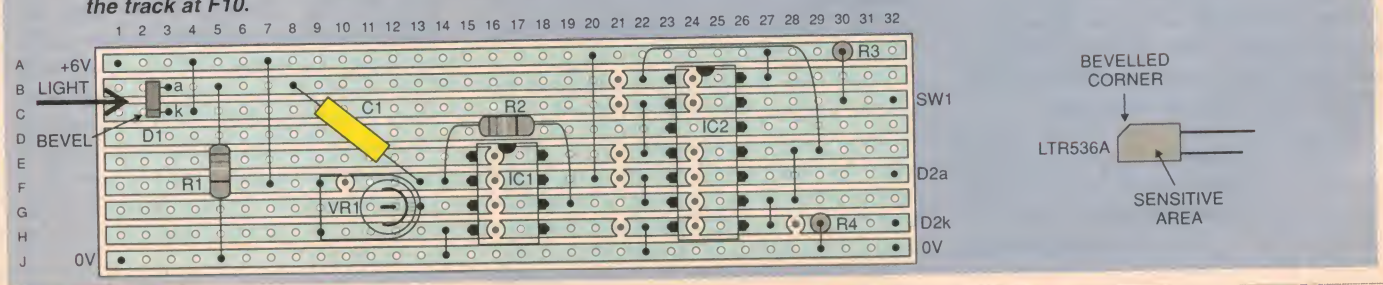
The R and C referred to in the equation are R2 and C1 in Fig.1. Those who remember their school calculus will recall that dvin/dt is the symbol for 'rate of change of vin'. For example, if a shadow falls on the sensor causing vin to fall from 4V to 3V in 10ms, this is a rate of change equivalent -100V/s. The formula above tells us the result: Vout = -3.3M x 390nF x -100 = 128.7V.

Of course, the amplifier can not deliver such a large voltage, but its output does its best and swings sharply to saturation in the positive direction. We therefore get a short positive spike every time the light falling on the sensor is rapidly reduced. As a person passes by there is usually a sharp positive spike, followed by a short negative spike as the light level returns to normal.

The output from the opamp is fed to a NAND gate wired as an inverter. The positive spike is made into a nice sharp negative going pulse that triggers a set-reset flip-flop constructed from two cross-connected NAND gates. Both inputs to the flip-flop are normally high but the flip-flop changes state when one of these is made low.

The push-button SW1 is used to reset the flip-flop so that its output at pin 3 is low and its output at pin 11 is high. In Fig.1 we are

Fig.3 When building the Door Guard, be sure to mount the IR sensor as shown — the diagram at left shows the light sensitive area on the device. Also, don't forget to cut the track at F10.



BY OWEN BISHOP

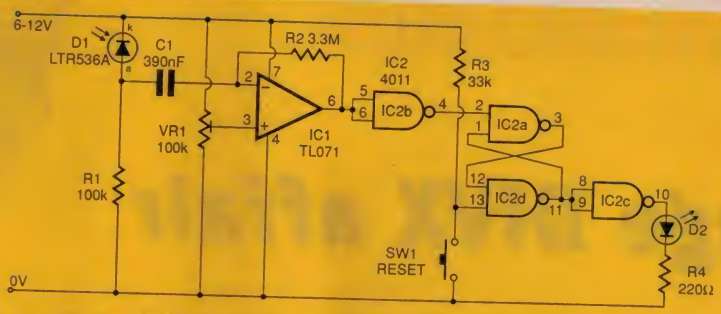


Fig.1

When the light level falling on D1 changes, the voltage developed across R1 changes proportionally. If this change is fast enough, the opamp trips and sets the flipflop. The output from IC2 can either light a LED as shown, or sound an alarm if you add the circuit in Fig.2.

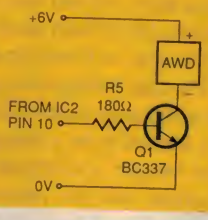


Fig.2

using pin 11 as the output to drive the remaining gate of the IC, which in turn drives the LED. When the output from the opamp is a sharp positive spike, the flip-flop receives a negative going pulse from the first inverting gate. This sets the flip-flop, and the output at pin 11 goes low.

IC2c inverts this output so that pin 10 goes high and supplies current to the LED. Once set the flip-flop stays set and the LED stays on until SW1 is again pressed.

Fig.1 has a LED as the warning indicator but several other kinds of warning are possible. For example the circuit can drive a transistor switch, as in Fig.2. The AWD can be anything from a small piezo bleeper to one of the really powerful screechers used in full-scale security systems.

The circuit can also be integrated into an existing security system, by using its logic output. Use the active-high high output at pin 3 or the active-low output at pin 11. Instead of an AWD, the transistor in Fig.2 can control a relay, which can be used to switch lamps, motors or sirens, or act as a switch for linking the device to an existing system.

Various types of CMOS or FET-input opamp could be used in this project. We chose the TL071 because it is able to operate on a low voltage supply (effectively +/- 3V), it has high-impedance inputs, and has a very high slew rate. This helps it to produce spikes peaking at +6 V to provide a definite logical high level.

Construction

The circuit is assembled on a rectangle of stripboard (Fig.3) with the sensor at one end. The cathode terminal (k) is distinguished as the longer terminal wire and also because it is on the same side as the bevelled corner. We'd suggest that you mount the circuit in a box, with a hole in the box to allow light to enter and fall directly on the sensor. SW1 is a push to make pushbutton mounted on the box, with leads connecting it to the pin labelled SW1 in fig.3, and to the 0V rail. You may also decide to fit an on/off switch in the 6V rail.

Note that the circuit also works on 12V, should you decide that you want more power for driving the AWD or a relay, however, we found that using a piezo screecher rated to operate between 6 and 15V, the noise was shattering even with the minimum 6V supply.

The circuit works over a wide range of conditions of illumination. But it is intended for low-level lighting and will saturate in bright sunlight. Setting up is easy; place the device where it is intended to operate, with the source light switched on. Connect a meter to pin 6 of IC1 (or pins 5 and 6 of IC2), and adjust VR1 to bring the voltage on the meter to about 1.5V. This is the equivalent of a low input to the logic circuit, but it will swing high whenever the light level falls rapidly. There is space at the end of the board for the switching transistor, if required.❖

Parts List

Resistors

(5%, 0.25 W)

R1	100k
R2	3.3M
R3	33k
R4	220 ohm
VR1	100k miniature horizontal trimpot

Capacitors

C1	390nF MKT or polyester

Semiconductors

D1	LTR536A (or equiv.) infra-red sensor
D2	LED any colour, size or shape
IC1	TL071 bifet opamp
IC2	4011 quad 2-input NAND gate

Miscellaneous

N.O. pushbutton; Stripboard 25 x 82mm (9 strips x 32 holes); 5 x 1mm terminal pins; 8-pin IC socket; 14-pin IC socket.

MOFFAT'S MADHOUSE

The strange DIVX affair

Once upon a time, there was a very silly boy named Tom. Tom liked to be among the first in technological matters, even though it cost him plenty. Tom once bought a Hanimex pocket calculator for $249, when similar things nowadays can be bought for, oh, two dollars or so. But the calculator was first, and it even served as the 'election computer' during a telecast of a Victorian state election a long time ago. Remember Sir Henry Bolte? And Dick Hamer?

When compact disk players came along, Tom just had to have one. He ended up with only the second CD player sold in Tasmania, for which he paid well over a thousand smackers. But — Tom was right up there with the latest technology.

More recently Tom shelled out over $200 for a little Rio MP3 music player. He just HAD to be first. Three months later you can get the same thing for less than half that. Yes, Tom sure knows how to throw his money away. I have to keep writing for this magazine just to support my unwise purchases.

So the scene is set for the latest rip-snorter impulse buy. As I've mentioned before, I work as chief engineer and producer for the local community TV station. Being a firm believer in 'why indulge in original thinking when you can rip off someone else's ideas', I decided to visit a larger community TV station in Olympia, the state capital of Washington, to see how they do things. Olympia is about the size of Hobart, with the same 'look and feel', so I decided to make a whole day of it. A colleague from the Port Townsend TV station came with me.

We spent the morning marvelling over this very advanced installation which feeds three TV channels at once, running programs from 18 videotape machines and two large studios. Several thousand words and stacks of digital photos later, we departed with handfuls of literature and lots of good ideas.

After a yummy junk-food lunch at the Burger King, we were cruising around Olympia checking out the sights when I spotted an enormous shopping centre, and a big sign advertising "DVD SALE!". DVD - little disks the same size as audio CDs, with full-length feature movies on them. Just like a video, only much, much better quality. My colleague is an incurable movie freak. She loves them, old and new, and watches several a week. She'd been lusting after a DVD player for ages, so it was time for a closer look.

The sign belonged to a consumer electronics chain store called Circuit City. In the past it's seemed to be a straightforward business; I've bought a telephone and an answering machine and the occasional video camera battery from Circuit City with no problems. So into the store we went, to be greeted by a smiling salesman.

"Forget about DVD", he said. "There is a new standard called DIVX and it's going to take over the entire recorded movie market. If you buy a traditional DVD player it will be totally obsolete within a year."

DIVX stands for "Digital Video Express". It is supposed to supplement and eventually replace the rental videotape market. Instead of renting, the viewer BUYS a video CD for $4.49. The disk is encoded in such a way that it can only be viewed for a 48 hour period, starting from when you first insert it into the DIVX player.

During that time you can watch your movie over and over until your eyes turn square, but after 48 hours the DIVX disk 'expires'. Three things can happen after that: you can simply throw the expired DIVX disk into the rubbish, you can buy a further 48 hours for $3.25, or you can arrange to have the disk 'made silver': re-enabled for viewing forever. This costs between $15 and $25.

The salesman was either totally ignorant, or he had been blatantly lying to us. The hard disk yarn sounded so convincing, but the manual revealed otherwise...

On the surface this sounded like a good way to 'borrow' a movie to see if you like it, and 'buy' it later if you can't live without it. As for me, I see a movie once and that's it - no desire for repeats. But my colleague is just the opposite; she likes to own every movie she sees and watches them over and over. Either way, DIVX sounded like it fit the bill.

At this stage I had some questions. Since you can't record on a normal CD, how did the DIVX disk know when the 48 hours were up? Why couldn't you just take it out of the player, re-insert it, and start the clock again? The salesman said it was a simple matter: the DIVX player contained a hard disk which could store details of which disk was played at what time, and prevent replay after 48 hours. And how did one make the DIVX disk play forever? The salesman said all you had to do was phone the DIVX head office, give them a credit card number, and you would be given a registration number which you could then enter into your DIVX player to make the movie 'silver'.

This seemed like a reasonable arrangement, especially since it appeared you could take an expired DIVX disk to someone else's player, a player with a different hard disk, and since it had no record of the particular DIVX disk being played, you could start the 48 hour timer all over again. It would be a lot cheaper if you could share the disks around.

Being the technical adviser, I told the lady she should buy DIVX. "OK", she said, "I'll have it." The nice salesman was even so generous, he threw in five free DIVX disks of her choice to sweeten the deal. And if she didn't like it, the player could be returned for a refund without question. So off we went with the new toy, and by the time we'd got back to Port Townsend I had agreed to install and set up the DIVX player for her, just to see how it worked.

Read the manual

If all else fails, read the instructions. Especially with something you know nothing about. And then the penny dropped with an enormous clang. The salesman back in

Olympia was either totally ignorant, or he had been blatantly lying to us. I suspect the latter is true, because the hard disk yarn sounded so convincing, but the manual revealed otherwise...

A DIVX player has no hard drive at all. Instead it has a modem, and to make any DIVX disk work at all you must first plug the player into a phone line and let it 'call home'. During this call you must register as a user, and set up an account with DIVX headquarters. Part of the contract stipulates that the DIVX player must be left connected to a phone line at all times, so DIVX headquarters can phone your player if it feels the need.

So the 'hard disk' the salesman claimed was in the user's player, is in fact at DIVX headquarters. THEY start the clock running when you first insert a new disk, and THEY disable your player after 48 hours. And THEY grant the authority, and ding your credit card, when you want to make the movie 'silver'. Another thing the salesman failed to mention was that many movie studios would not permit their productions to be made silver. They wanted to be paid every time.

So, despite the salesman talk, you do not own a playable movie. All you own is a plastic disk, and DIVX headquarters still controls your use of it. It is possible, unknown to you, that your kids could could keep ordering further 48-hour periods for movies they especially like, not realizing the cost involved. If you then refused to pay, DIVX headquarters could un- register your own movies, disabling them until you paid the kids' fees. Should you get sick of all this and close your DIVX account, all your 'silver' disks would suddenly become no longer registered, and thus, useless. So nothing, really, is ever yours.

Another issue is privacy. The central DIVX database could keep a record of every movie you watch. A list of this information would be a useful marketing tool if sold to something like a mail-order house. Your viewing habits would be a good indication of your tastes in other areas, and could result in some selective junk mail heading your way. It would be interesting to see what turned up if your habits included lots of flicks like 'Debbie Does Dallas'.

After reading the instructions, and some research on the internet, my colleague decided to put the DIVX player back in its box and return it forthwith to the nearest Circuit City store. But, the fine print in the return policy said there would be a fifteen percent re-stocking fee on any returned goods. That's $75 down the chute for a $500 DIVX player. So, she decided, she was stuck with the thing and had to make the best of it.

Later digging on the internet revealed some interesting things about DIVX. The whole idea was apparently cooked up by Circuit City in cahoots with a big California law firm. It was not an 'industry standard' at all. Another big retailer, the Good Guys, somehow got sucked in on the deal, but other than that, nobody in the video movie industry would touch DIVX. You could go into a big rental chain like Hollywood Video or

Below is the Proscan PS8680Z DIVX player, with the more versatile JVC XV-DX1BK DIVX/DVD above. It's not surprising to hear that the DIVX format has already died. Perhaps old DIVX discs will one day become collector's items - then again, perhaps not...

Blockbuster Video and they'd say "DIVX? What's that?". There would be hundreds of DVD's on display for sale or rent, but no DIVX.

It didn't take a techie to figure out that the DIVX phenomenon was not exactly consumer-friendly, and on June 16 an announcement appeared: *"Digital Video Express, LP announced today that it will cease marketing of the DIVX home video system and discontinue operations, but existing, registered customers will be able to view discs during a two-year phase-out period."*

And, for people who bought DIVX players under false pretenses, and then later learned the truth, justice has been done: *"Digital Video Express will provide a $100 cash rebate to all consumers who purchased Divx-enhanced players prior to June 16, 1999. Rebate forms will be available at www.divx.com, participating retailers and by calling 1-888-639-DIVX. The rebate will ensure that no DIVX customers have paid more for the DIVX-featured player than they would have paid for the least expensive, comparable DVD player available at the time of their purchase."*

And things aren't as bad as they seem for "silver" disks that will stop working on June 16, 2001. DIVX is offering to refund the registration cost of silver disks upon request. The DIVX-enabled players will keep on going, although burdened with useless internal modems and some meaningless on- screen menus. But most of them are pretty good DVD players in their own right, made by top manufacturers. So the DIVX adventure has done no permanent harm, and maybe it's taught marketing types that it's not so easy to fool the public after all.

Sony CD-ROM

Speaking of electronic retailers, an update: About a year ago I was having a terrible moan about my Sony laptop computer which was a difficult beast indeed running Windows 98, but a docile lamb when converted to Windows 95. At that stage Sony tech support gave me and my brand-new computer the heave-ho, since it was no longer running the "factory-supplied operating system" - even though it was now running much better than before. There were many other rude comments in internet newsgroups about Sony tech support.

Last week, mere hours before the warranty expired, my CD-ROM drive died. This is a user-changeable unit that swaps back and forth with the floppy drive. The computer was being used to supply the music for a dance revue (see last month's Madhouse) via MP3 files, most of which originated from music CDs.

During rehearsal, the producers decided to add a couple more numbers, but when I plugged in the CD-rom drive to feed the music into the computer, it wouldn't go. Dead as a doornail, although it had worked fine a couple of nights earlier. The following day was dress rehearsal followed by the first performance that night - a fourteen hour day for me. So I couldn't report the failure to Sony until the next day, which was the day after the warranty had officially expired.

When I finally phoned Sony my call was answered within a couple of minutes, and when I told the guy I was running Win95 he didn't even flinch. He led me through some diagnostic procedures and then we were both certain it was a hardware problem with the drive itself. There was some discussion about the warranty, and finally the tech either had to take my word for when the unit failed, or refuse to honour the warranty. He did the right thing, and the next day, by very expensive overnight express freight, a new CD-rom drive arrived at my door.

So — I'd better take back my previous nastiness, and also report that in the latest issue of PC Magazine, Sony was rated second out of seventeen notebook manufacturers for overall quality (IBM was first). Last year nobody had even heard of Sony notebooks. A major improvement, much welcomed...❖

COMPUTER CLINIC

Is Win98 worth the upgrade? booting up to Win95 or NT, zapping a B drive, and some terrific text tools.

Upgrade to 98?

I have Win95 running on two networked (peer-to-peer) 100MHz Pentium machines. There's also a 486 and 386, each running Windows 3.11. Each of the Pentium machines has 40MB RAM, and current builds of both are stable (as far as Win95 can be!).

I'm thinking of upgrading to Win98 release 2, as I have heard it will allow better resource sharing than peer-to-peer under Win95. In particular I want to be able to access my modem from any Win9x machine on the network (each has its own at the moment!) and also access other peripherals such as scanners. Would you recommend this upgrade or is there an alternative solution that will give me TCP/IP and COM port sharing? (Angus and Jennifer Witherby, by email)

OK, I haven't had a chance to play with Win98 SE yet myself, but by all accounts, the internet sharing is simple to set up, and pretty reliable. In true MS fashion, however, it's not designed to be easily fiddled with, so if you have problems with your connection, fixing it can be a right pain.

As for upgrading to the Second Edition... well, they've fixed a few bugs, and added a few other features, including improved Y2K handling and Euro currency support, but it's no great shakes. The upgrade to 98 SE is now free for registered Win98 users, so if you had 98, it would probably be the most sensible option. As you have Win95, however, you'd need to purchase the upgrade version of Win98, which will set you back around $150.

I've been using 98 for a couple of months now, and quite frankly, it isn't worth all the fuss. There are a few nice touches here and there, the hardware detection is a little nicer and the USB support actually works, but quite frankly once you turn off Web View and other cutesy cosmetic features, it looks and feels just like 95.

As it stands, no version of Windows offers native port sharing. You could use something like ArtiSoft's ModemShare 32, (from **http://www.artisoft.com/products.html**), but this costs US$259 for a two COM port licence, and really isn't a terribly good solution for most people. The same goes for scanners — if your scanner doesn't support LAN use, then there's no useful way of doing it.

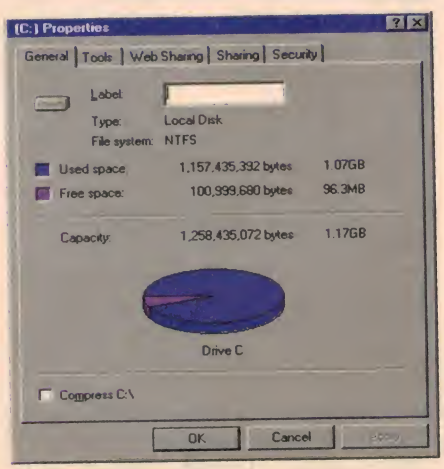
If you just want internet sharing, go and download a trial version of the best NAT utility I've found so far: Sygate. (**http://www.sygate.com**) It's ridiculously easy to set up, and it just works. The demo is limited to 100MB transfer across it, but the full version costs US$40 and it's worth every cent. It has a nice text-based config, too, so if you want to play around with it, you can. All in all, my personal recommendation is to forget upgrading your OS for now, and wait for Windows 2000. You might need a bit of a hardware upgrade though — a fairly beefy PII with 64MB is about the lowest you'd go if you expect to actually achieve anything with Win2K. It will be worth it, however...

Booting to NT or 95

I have NT installed on my PC. This is now presenting a problem as a good deal of software doesn't want to run unless 95/98 is installed, which is a pain. I am a Macophile as you know so I'm clueless about PCs. Is there a way to choose either NT or 95 as the OS when you boot up? (John Loadsman, by email)

Yes, NT and 95 (or 98) can coexist quite happily on one drive, but there's one important proviso: if your C drive is formatted as NTFS (NT's own rather fancy high-security filesystem), then I'm afraid you'll have to completely reinstall NT, using FAT16 (the standard DOS/Windows 95 filesystem) before you can set up a dual-boot machine.

Assuming that C drive is FAT16 already (have a look at the Properties of the drive in My Computer if in doubt), you're ready to do scary things to your boot sector. The first thing you'll need is the Emergency Repair Disk. You should always, always have an up-to-date ERD, especially if you're considering making any significant changes to your system. To create one, put a blank floppy in the drive and run RDISK /S from the command prompt.



Next, find your Windows NT setup floppies. If you don't have them, you can recreate them simply enough by inserting the Windows NT CD, opening a command prompt, and running WINNT32 /OX from the \i386 directory. You'll need three floppies for this, so be prepared. Third and last, you'll need a DOS bootdisk of some kind, with SYS.COM on it. Windows 98 comes with a useful boot floppy, as does the old floppy distribution of Windows 95, but if you don't have one, you can make one on a friend's 95 box, by going to Start|Settings|Control panel|Add/remove Programs ->Startup disk.

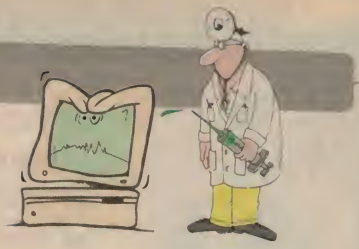
Boot off your DOS/Windows 9x boot floppy, and type SYS C: to install the DOS boot sector. This will nobble your NT installation until you repair it, so make sure you don't do this when you might need to run NT in a hurry..

Now reboot and install Windows 95 by running SETUP off the CD and following the prompts. Of course, you'll need DOS CD drivers in order to access your CD-ROM — I covered these in the March 1998 issue, so you might like to check it for details. Once 95 is up and running, it's simply a matter of restoring the NT boot loader.

Reboot once again (are you missing your Mac yet?) from your NT boot floppies and hit R at the menu to Repair your NT installation. Select Repair boot sector, then exit and reboot yet one more time, which should with any luck show you the NT boot loader again.

Now all that's left to do is to add Windows 95 to the boot menu, if it hasn't done so already. This is done by editing BOOT.INI, a hidden file on C:\. Open a command prompt and type ATTRIB -H -R -S C:\BOOT.INI so Explorer can see it. Open the file in Notepad, and add the line C:\="Microsoft Windows 95" at the bottom of the [operating systems] section. Save and exit, then ATTRIB +H +R +S C:\BOOT.INI just for paranoia's sake. Next time you reboot, (yes, again) the boot menu should have the option to start Windows 95. Have fun!

BY JEAN-BAPTISTE CATTLEY



Got any computer queries? Whatever is bugging you, from hardware problems to C programming, send it in and we'll soon have you fixed up. You can email your question to electaus@fpc.com.au, or fax or mail it in to us here at EA.

Text tools

I've covered a couple of decent word processors in this column, but one of the shortcomings in Windows 95 is the lack of a really good simple text editor. There's Notepad, which, though small, efficient and simple, has some serious shortcomings. One of which is that it can't handle files larger than 64K. (The NT version can handle files of just about any size, but it's not a fun experience...)

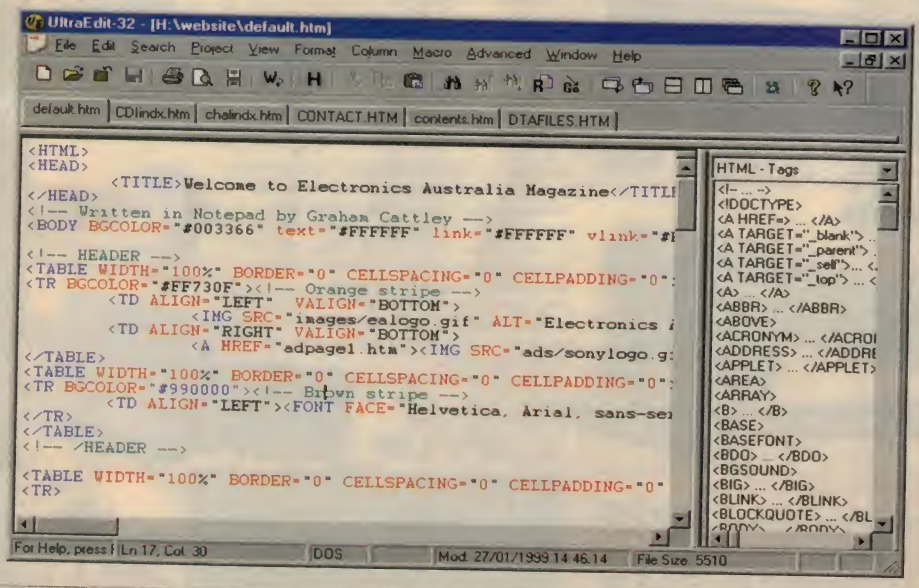
Then there's Wordpad, a 32-bit port of the ghastly Write.exe that plagued 3.1 users for years. Possibly the ugliest program that comes with Windows, Wordpad is neither a text editor or a word processor, but tries to be both, and fails miserably. It has neither the features you'd expect in a WYSIWYG prog, nor the convenience of a simple editor. It has a few bugs as well, and the performance drops to a crawl on files bigger than a few hundred K. All in all, what the world needs is a decent replacement for both of them.

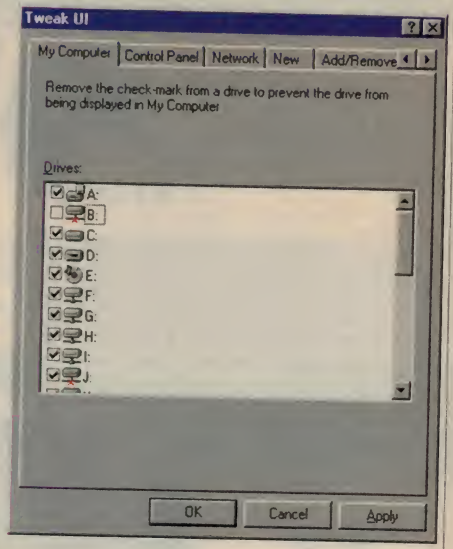
Luckily, I've found a couple of apps that fit the bill nicely. The first is PFE, the Programmer's File Editor. Designed with the programmer in mind, PFE is small (it fits on a floppy), fast, and packed with useful features. It supports drag-and-drop editing, line numbering, smart indent (pressing Enter on an indented line will start the next line at the same indented position), macro recording, multi-level undo, alternate configuration for different filetypes, Unix <—> DOS text conversion at the click of a mouse, and the very useful ability to run a DOS command upon the file you're editing and optionally capture the output to a new window...

The programmers among you will love this feature. PFE is freeware, as well, so if you're in the market for a decent notepad replacement, then look no further. Grab it now at **http://www.lancs.ac.uk/people/cpaap/pfe.**

If you're feeling a little more ambitious, and you want a little more grunt to play with, then check out Ultraedit, from IDM. UE has all the features of PFE, and a whole lot more besides. There's a 100,000 word spell checker, syntax highlighting for dozens of programming languages including Perl, C++, HTML and Java, a hex editor mode, an FTP client to allow loading and saving directly to the Internet (perfect if you're doing a web page) and dockable quick-text lists for HTML tags and common function definitions etc.

Then there's a Functions List that picks out the function headers in your code, and keeps a list of shortcuts in a dockable list, allowing you to jump directly to them. I could go on for hours, but far easier would be for you to download a trial copy from **http://www.ultraedit.com**. Ultraedit is shareware, but if you have to deal with large amounts of text on a regular basis, the US$30 regstration fee is well worth it. Many thanks to my great friend Dyanna Pedroza for putting me on to this one.





B: aware

Since I installed a new ZIP drive (internal IDE) in my computer, Explorer shows a B: drive as well as the new D: drive that is the new ZIP. If I try to look at the contents of this mythical B: drive, my computer locks up. What can I do about this?

The most likely cause of this 'Phantom B: drive' problem is that your motherboard's BIOS isn't completely compatible with the ZIP drive.

There are a couple of things you can do — apart from buying a new motherboard that is... The first thing is to look on your motherboard manufacturer's web site, and see if there's a Flash BIOS upgrade for your board. If so, it may well solve the problem.

Failing that, you can try and prevent the BIOS from detecting the drive in the first place. Ensure that the entry for that IDE port is set to 'None' or 'Not Installed', or you can even try setting it to a User Defined drive type, with zero heads and zero cylinders, although this is an awful kludge.

Of course, if attacking the cause of the problem doesn't help, you can always cheat, and treat the symptoms. Get TweakUI, (part of the PowerToys collection, available free from **http://www.microsoft.com**), and simply uncheck drive B: in the My Computer tab. This will hide the drive from Explorer, and keep the whole problem out of your hair. It's an even worse kludge, but remarkably effective nonetheless.❖

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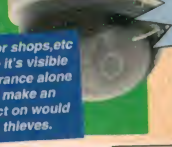

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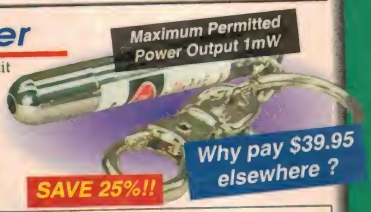

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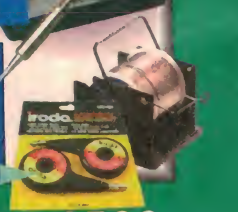

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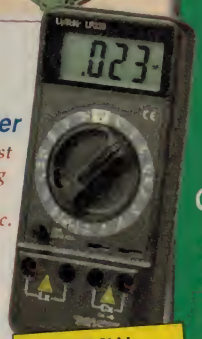

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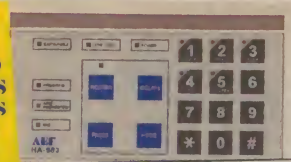

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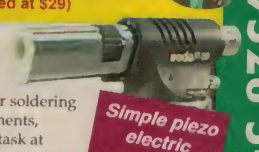

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Vintage Radio

BY ROGER JOHNSON

The year that was — 1928

At the end of my 'the year that was' article for 1927, I wrote that 1928 was a radically different year. It was, but 1928 was a case of 'more haste less speed' because although there were plenty of changes, there were also plenty that remained the same!

IN FACT THERE were two periods in the 1920s when there was not a lot of change; 1925 - 26 was one period, while 1927 - 28 was the other. There are features common to both those periods which makes it almost impossible, unless there is other supporting evidence, to identify a given radio as a 1925 or 1926 model, and similarly as a 1927 or 1928 model.

Once again resource material was a little scant for 1928, but I've managed to find enough to give an overall impression of the year. To begin, let's look at the things that *didn't* change much from 1927 to 1928.

Firstly, sets for the home constructor were still all-triode battery sets — some neutralised, some not — but with filament rheostats for the RF stage or stages, and individual tuning capacitors for the required number of stages. We therefore often had three-dial tuning, which together with the rheostats, meant that tuning required knowledge, dexterity and skill. Tuning 'the wireless' was definitely still the man's department!

Not only were there circuits for 'three-diallers' and the like, but for example the September 5 issue of *The Listener In* gives the circuit for a 'Browning Drake' set in a most handsome tapered-leg table cabinet, described for the home constructor. This circuit could almost have been regarded as obsolete in 1928, for there were advances in other fields, and by then the circuit was three years old.

Next, coil kits were being sold by 'Radiokes' for the neutrodyne and Reinartz radio circuits. The coils as advertised were similar to those already illustrated in previous 'snapshot years', with the exception that there were other manufacturers producing ready wound coils, and the Radiokes Reinartz coil was still wound on a 3" former and placed in an enormous metal can!

Fig.2: The beginning of the end — a Harringtons battery five valver circa 1928, without neutralising but with ganged 'single knob' tuning...

Also, the usual run of bright emitter valves by Ediswan and Mullard were now being offered very cheaply, for as low as 3/- to 5/- each.

The large stores such as Hartleys, Mick Simmons and United Distributors were selling two- and three-valve battery triode radios, capable of loudspeaker operation, complete with valves and other accessories for very modest sums indeed — priced between £5 and £6, or merely *one* week's wages. The speaker was still regarded as an 'extra'. Philips were still marketing their popular and well performing 'PCJJ' range of speakers.

Finally, there were those listeners and readers who still preferred crystal detection above all others, and the correspondence pages of the wireless magazines contained no shortage of requests for selective crystal sets followed by a valve amplifier, or valve radios using a crystal detector. Some habits died hard!

Screen grid valves

It's true to say, though, that 1928 marked the introduction of the screen grid valve. The term 'screen grid' has been especially chosen here to reflect the nomenclature of the day. They were not regarded as tetrodes, nor pentodes (which in RF stages they were not).

The first such valve on the scene is generally regarded as the Marconi S625, with its unusual double-ended construction. It is illustrated in Fig.1. As you can see, it is intended for horizontal mounting, and has socket connections at both ends. Soon after the Osram S210 (2V), S410 (4V) and S625 (6V) were all released for battery operation, and together with the other brands, had the

more conventional shape with the top cap anode connection.

Note that Marconi and Osram *both* had a type S625. These are quite different valves, despite the same type number!

This is a very clear example of what was to become a bit of a problem: the numbering systems adopted by European manufacturers. Each manufacturer had its own system, and when quoting a valve number it was necessary to know the manufacturer as well. (In contrast, the American valve manufacturers had a uniform numbering system from the early 1920s, adopted by all manufacturers)

Cossor released their 215SG for their 'Melody Maker' kit set radio. Philips also released the A442, and Mullard the PM12 and PM14, in the same year.

Fig.3: The 'Centurion Phono & Radio' — a combination radio and electric gramophone in its massive 'dinosaur' cabinet. (Listener In, September 19, 1928)

US valve types

Although the US valve types 226 and 227 were generally regarded as having been released in 1927, there appears to be little reference to them in either 1927 or 1928 as available for the home constructor in Australia. However they must have well and truly been in the country, because the advertisements for 'King' and 'Crosley' and other popular US brands were aplenty, and all of these sets were powered with 226s as RF and audio amps, a single 227 detector, a UX171A audio output and a type 280 rectifier.

But there *was* mention of the new UX171A for home construction, and believe it or not, a UX200A was discussed in the 'Tested by Us' column in *The Listener In* for February 15th 1928. The 171A is understandable, but the UX200A was apparently the first of the re-released UV200. This does seem rather surprising, as the UX201A had replaced the UX201 by about 1925.

Also released were the Marconi Osram DEL-410 and DEP-410, which were used exclusively in the AWA Radiola models for several years. Philips released their power triodes B409, B405 and B403, which incidentally were suitable for AC operation as well as DC, and in the six volt range, the B605 and C603. The C603 has a 6V filament but is in every other way identical to the 171A, which required only 5V on the filament.

There was some literature that claimed they were interchangeable. This would be unwise, particularly today when such valves are scarce. Running a 171A on 6V would seriously compromise what remaining life it has left!

Another AC type power valve which was mentioned was the type 210, which was popular for the 'final' amplifier stage in amateur transmitting equipment.

Philips also released the types A225, A425 and A630, which were specially designed for resistance coupling. Philips and 'Lissen' released special 'resistance coupling units' which contained an anode load resistor, coupling capacitor and grid leak, wired and assembled into a single container with four terminals — corresponding to the terminals on a coupling transformer (P, B, G and F).

Later in the year, Philips released their 'power penthode' (sic) type B443. This was initially released with a UX base, with the screen connection via a grub screw connector at the top of the base. This was done so that it could be merely plugged into an already existing UX socket without major rewiring. It was later released in versions with UY and B5 bases as well.

Loudspeakers

When it comes to loudspeakers, one thing seems very apparent from the literature: the horn speaker was well and truly on the way out. The new 'cone speakers' received the saturation advertising, with the old horn speakers being relegated to the 'clearance sale' category with prices slashed.

The brands which received prominent billing were Celestion, Amplion (of course), Stromberg Carlson, Operadio (though not strictly a cone speaker, but a successor to the horn), the RCA 100A and the Magnavox. Speaking of Magnavox, they released their first electrodynamic speaker in 1928. These sturdy and expensive units came complete with their own power supply, and two models had to be plugged separately into the mains for their operation.

One model had a high voltage transformer and a copper/copper oxide rectifier, in which the field coil was the complete load. Others had a low-voltage field excitation coil which operated from a six volt accumulator — and if the advertisement is to believed, drew a staggering 65 amps! (Of course 0.65 amps is

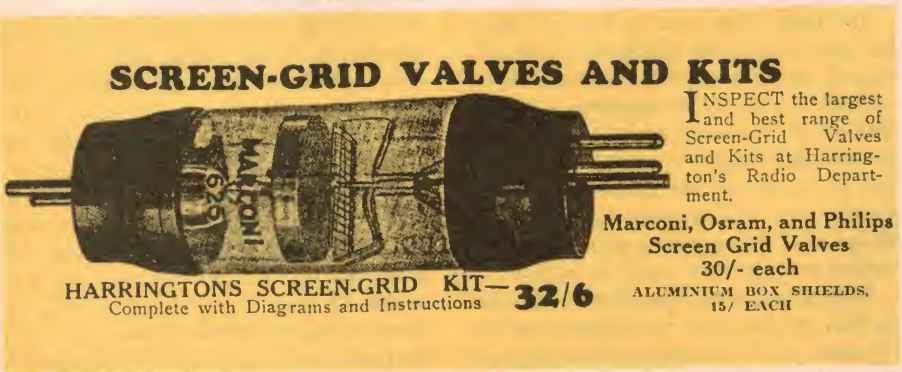

Fig.1: An advertisement for the Marconi S625 screen-grid valve, from 'The Listener In' for November 14, 1928.

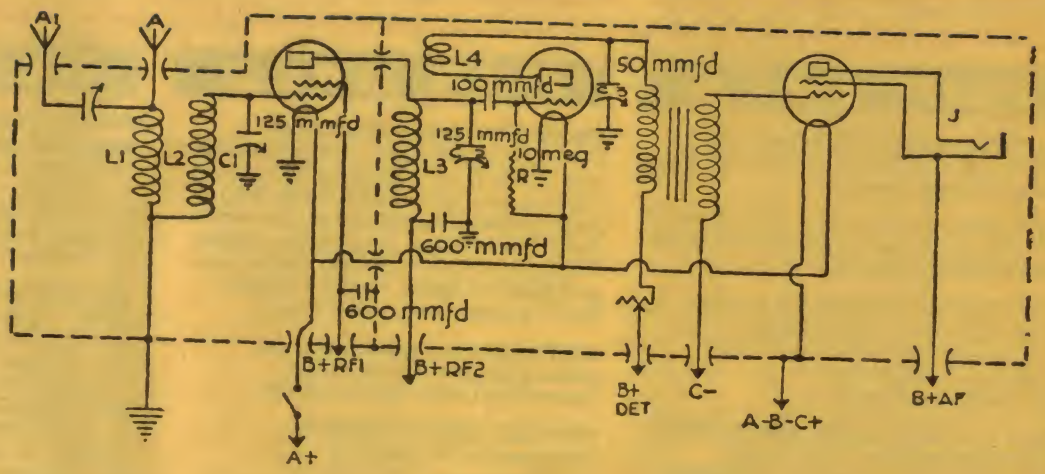

Fig.4: One of the early circuits using screen grid valves, the 'Pentrode Three' described in the November 14, 1928 issue of The Listener In.

a more likely figure, otherwise the accumulator would be flattened in a matter of minutes. 65A is about half the current drawn by an automobile 6V starter motor...)

Radiograms & dinosaurs

1928 introduced the mainly imported all-electric sets, and many models had provision for a 'pickup'. This rather frivolous term meant a connection for the magnetic head of a gramophone. After all, it 'picks up' the signal from the record, doesn't it?

The magnetic gramophone heads of the day still had steel needles, which needed changing in exactly the same manner as their acoustic counterparts; but instead of vibrating a diaphragm, they vibrated a tiny coil encased between the poles of a powerful magnet. As a result they produced an audio voltage, capable of being amplified and played through a loudspeaker.

The pickup input connection was usually straight across the terminals of one of the receiver's audio transformers. In some circuits they were placed across the primary; in others, the secondary. (Having heard a 1929 model electric radiogram, I suggest there is little to choose between it and a well designed acoustic gramophone.)

To facilitate the new radio-gramophones or 'radiograms', came the electric gramophone motor. The earliest were advertised as being suitable for AC or DC operation, thereby indicating a series-wound motor. Quite often these were placed in enormous and elaborate cabinets, and have been nicknamed 'dinosaurs' because of their size. Such an example is the Centurion Phono & Radio illustrated in Fig.3. This style of cabinet endured for four or five years until about 1932, but were only affordable by the well-to-do. Such samples are quite rare, and possibly represent the most artistic of all radio cabinets ever made. They are keenly sought by serious collectors.

Other products

Many of the items familiar to vintage radio collectors and enthusiasts can be traced back to 1928. AWA's 'Ideal' audio transformers and logarithmic tuning capacitors, for example; 'TCC' bypass and filter capacitors (paper with wax impregnation) in their familiar rectangular metal can; Emmco 'centra-line' tuning capacitors and 'pep-punch' audio transformers; Radiokes coils, chokes and other components; and last but not least, 'Eclipse' components.

One other item which seems to have prominent advertising in 1928 were the first portable radios. There were no shortage to choose from, including the Astor 'Porta', 'Airmaster', 'Airzone' (the same thing?), 'Kodel' 1-valver and the 'Traveller' five valver obtainable from Warburton Franki stores in Melbourne, Sydney and Brisbane. United Distributors were also offering their own brand, in all-leather cases.

Astor didn't only release their Porta model; they also introduced the Shielded Two, Shielded Three, Little Astor, Astor 5 valve neutrodyne, and Astor All-Electric. The five valve neutrodyne and all-electric models were available in table or console cabinets for a higher price.

But probably the most visible of new products in 1928 were the all-electric sets. These were mostly imported sets made by the large American firms that are familiar to today's collectors: Stromberg Carlson, RCA, King, FADA, Freshman, Udisco, Centurion as previously mentioned, and Crosley were all available. Being American, these had a very predictable valve line-up as mentioned before. However, the prices started at about £55 and went upwards.

In competition with these electric sets were the battery eliminators and trickle chargers that would enable the owner of a four or five valve battery set to operate it almost as an electric set — i.e., just plug it in and forget it. These were available for as little as £12 - £15, providing a more economical alternative.

Summary

Technically, 1928 would have to be remembered for the introduction of the screen grid valve, and a circuit for just such a set appeared in *The Listener In* for November 14th, 1928 — fairly late in the year.

The circuit is illustrated in Fig.4. Entitled 'The Pentrode Three', it's essentially a simple Reinartz detector with one screen-grid valve ahead of it as an RF amplifier, and the other following it as an audio amplifier. Plug-in coils for L1, L2, L3 and L4 adapted the RF and detector stages for short wave listening. ❖

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(Continued from page 77)

or out - not a terribly elegant procedure and you can't see the results until you get your hand out of the way, but it's effective none the less.

Eyeing the eye

For those who find this sort of thing interesting, you can completely unscrew the faceplate and see the actual image sensor directly. You can make out the 4.8 x 3.6mm imaging area of the 10mm square chip, and see the edge of a *very* small circuit board behind.

Enough of this technical stuff though, how well does it work? Well, lets see, to try it out we'll need a 5V supply, and a suitable video cable to hook it up to something... after two minutes with the soldering iron in the lab, we emerged with an ungainly contrivance that did the camera an injustice. The lab's bench supply and lumps of coax were pressed into service and the whole mess was dragged down to the company's IT department, where we stood staring intently at the only computer in the building with a video capture card.

Eventually the IT guys got the message, and the results are reproduced here for your edification. We're now constructing a much more streamlined version based on a 9V battery and regulator, and the results should be far more appealing. Of course you don't need a video capture card or even a computer to use the C-cam2 - it puts out standard CCIR video, and so can simply plug into a VCR, video monitor or any TV with A/V inputs.

Now, after raving on about the tiny C-cam2 you'd expect us to follow up with a huge price tag. Well we won't. Oatley are selling the thing for only $79, *and* they're throwing in a VHF modulator, *and* a plug-pack, *and* a spec sheet... You have no excuse. Go and buy one, they're fun.❖

C-cam2 miniature video camera

A Sugar cube sized black and white video camera, with pinhole lens and 240 TV lines (288 x 352 pixel) resolution.

Good points: *Dead cute. and cheap too.*

Bad points: *Not the highest resolution, and colour would be nice...*

RRP: *$79, including modulator and plugpack.*

Available: *Oatley Electronics, P.O. Box 89, Oatley, NSW 2223; Phone: (02) 9584 3563; Fax: (02) 9584 3561; Email: oatley@world.net; Website:* ***http://www.oatleyelectronics.com***

Forum...

(Continued from page 42)

With the dawning of the 'digital era', I wonder how many technicians and TAFE lecturers will bother to learn about DVB-T, COFDM and MPEG? Not very many, we would guess. The concept of over 7000 individual carriers within a TV channel bandwidth would probably be too much for them, and the concept of FFT would probably send them running to another trade.

It seems to me that many in the electronic service trade are very scared of new technology. This should be of some concern, as who will repair these new, very expensive, high definition TV sets if no one knows how they work?

In my opinion the whole training system and attitudes need to be changed. We cannot go on living in a denial of new technology. The service trade needs to be licensed and the people involved must be periodically tested to make sure they are up to standard. The trade courses need to be made a lot more relevant to modern technology, and cheap upgrade courses should also be offered.

Changing the subject, I've been reading EA since the early 70s and have found your magazine both interesting and helpful. I find, however, that some of your projects and articles to be a bit behind the times. This is probably an indication that your readers are somewhat older than 20 years ago. There seems to be little excitement or enthusiasm in electronics any more, and I suspect this is causing electronics to not be considered as a hobby by younger people.

Thanks for those comments too, Alan. You raised some very interesting points, and I suspect you're right about many people in the servicing industry being scared of new technology, and the reasons for the dearth of good in-service training.

Perhaps we haven't kept up with all of the latest technical developments in EA, either. In our defence, though, that's partly because we don't get nearly the support from industry that we once did, in terms of advertising. This has inevitably reduced both the magazine space we can devote to good 'new technology' articles, and our resources to provide them.

There's clearly a 'vicious circle' phenomenon operating here, isn't there? ❖

Electronics Australia is one of the longest-running technical magazines in the world. We started as *Wireless Weekly* in August 1922 and became *Radio and Hobbies in Australia* in April 1939. The title was changed to *Radio, Television and Hobbies* in February 1955 and finally, to *Electronics Australia* in April 1965. Here are some interesting items from past issues:

50 years ago

September 1949

3000 Valves for a Super Brain: The electronic brain or calculating machine is one of today's marvels. Information needed for calculation is fed into it by a perforated tape, then after passing through the intricate device, which uses 3000 valves in a series of racks, the result is printed on a teleprinter machine.

The full name of the equipment is Electronic Delay Storage Automatic Calculator, or EDSAC for short. It was built at the Mathematical Laboratory of Cambridge University and can add, multiply and subtract. It can solve problems in a few minutes which would otherwise require months of calculation. Mr M.V. Wilks is Director of the University Maths Laboratory.

Television Telescope: An interesting use for television has been described in the USA. Tied to the eyepiece of a big telescope, it shows a picture on a screen so that a number of observers can examine it, instead of only one — the operator who normally looks into the eyepiece.

The great amplification required calls for a 2000-line per frame picture, and 120 frames per second. The image is amplified to the size of a disc 64 inches in diameter.

25 years ago

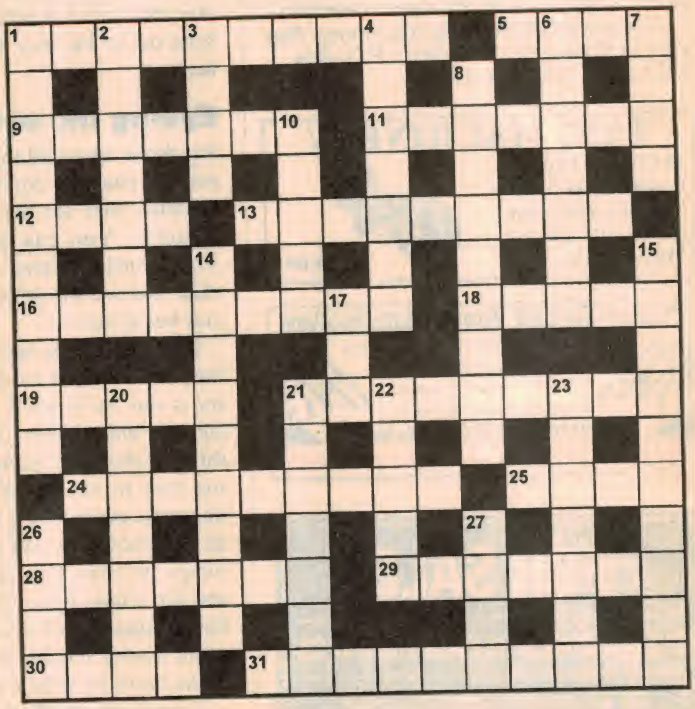
September 1974

Large Capacity Magnetic Bubble Memory: A 'magnetic bubble' memory that can store information equivalent to 27,000 telephone numbers has been developed by scientists at Bell Laboratories. Magnetic bubbles are minute magnetised areas located in thin films of crystalline magnetic material. These magnetic areas can be created, erased and moved about electronically, to store and transport data in computers, mini-calculators and telephone switching systems.

The new memory has a storage capacity of 460,544 bits of information, and is the smallest yet devised using magnetic bubble technology. The size of the bubble pack is 95mm long, 44mm wide and 21mm deep. It has an average access time of less than 3/1000 of a second and a data rate of 700,000 bits per second.

Magnetic Card Records Colour TV Programs: The Sony Corporation of Japan has developed a video record/playback system that makes use of a flat magnetic card as the recording medium. Designated 'Mavica', the system employs envelopes containing two 6-1/4 x 8-1/2 inch magnetic cards. The envelopes are inserted into a small player/recorder which is connected to a colour TV set. Each card set has a playing time of ten minutes of colour picture and stereo sound. ❖

Crossword



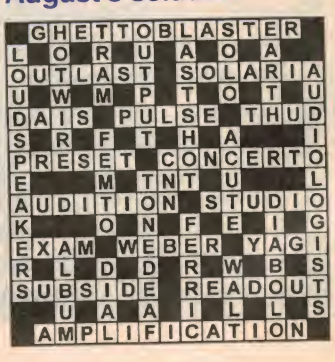
Across

1 'Show and tell' of a communications network? (10)
5 Tape-recording apparatus. (4)
9 Become disjointed. (5,2)
11 Musical instrument. (7)
12 Abbreviation for assembly. (4)
13 Passive amplifier. (9)
16 Hands-free device. (9)
18 Objectionable. (5)
19 Umbral time. (5)
21 Speaker in a broadcasting studio. (9)
24 Communicating device. (9)
25 Spot of radar. (4)
28 Winding path. (7)
29 Sign of zodiac. (7)
30 Black and white. (4)
31 Play-back device. (9)

Down

1 Electronic musical instrument. (10)
2 Place for echo sounder use. (4,3)
3 These could be found in an arboretum. (4)
4 Chemical group containing nitrogen. (7)
6 Increases signal amplitude range. (7)
7 Flier associated with Franklin. (4)
8 Tenor tuba. (9)
10 Prefix meaning pressure. (5)
14 Fuses metal surfaces electrically. (4,5)
15 Underwater sound detector. (10)
17 Type of transistor. (1,1,1)
20 Explosive shell with fuse. (7)
21 Close follower. (7)
22 Digits. (5)
23 Song with West Indian style. (7)
26 Atmospheric pollution. (4)
27 Repetitious execution of group of instructions in a program. (4) ❖

August's solution:



Electronics Australia's

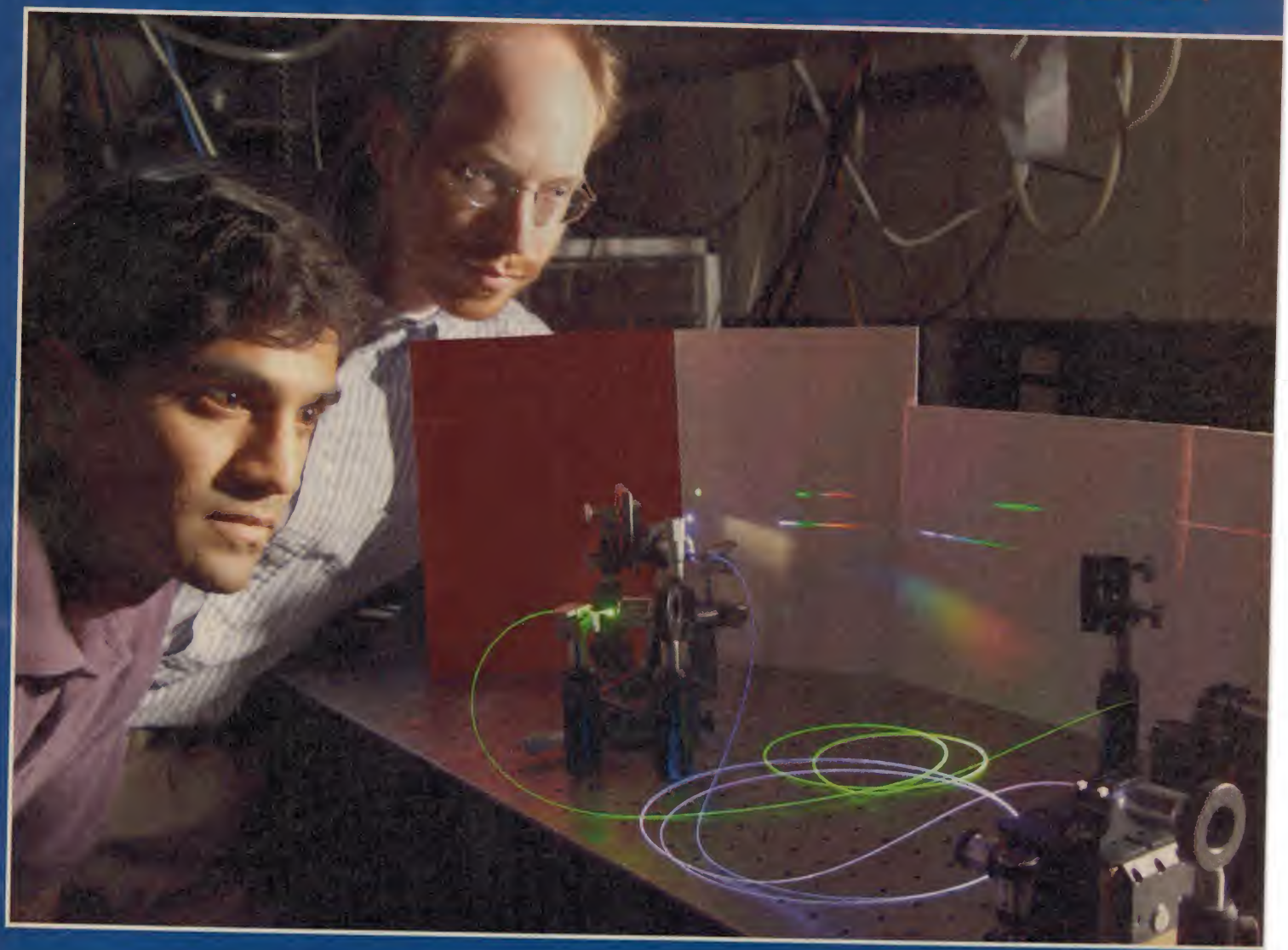
Professional Electronics

Portable iMac has wireless internet access

Powerful half-size single board computers from Inside Technology support K6-2

New Analogue Electronics CD-ROM from Matrix Multimedia

Review of new low-power UHF transceivers



Lucent Technologies' new low-loss optical fibre converts white light into all colours of the spectrum...

NEWS

HIGHLIGHTS

Electron microscope achieves better than one-angstrom resolution

Using the One-Angstrom Microscope (OAM) at the National Center for Electron Microscopy (NCEM), researchers at the Department of Energy's Lawrence Berkeley National Laboratory have made unprecedented images of columns of carbon atoms in a diamond lattice, only 0.89 angstrom apart — less than one ten-billionth of a metre.

Importantly, this is the first time an electron microscope has been able to resolve nitrogen atoms in the presence of more massive gallium atoms in gallium nitride, in columns spaced only 1.13 angstroms apart.

"The ability to make images of light elements such as carbon, nitrogen, and oxygen in solids at atomic resolution is a very big step forward — and it was achieved by a technique that can be a routine tool in the future." says Christian Kisielowski, who with Michael O'Keefe and their colleagues Christian Nelson, Chengyu Song and Roar Kilaas of Berkeley Lab's Materials Sciences Division recently announced the record-breaking result.

Many of the most promising solids under investigation today, including superhard materials, high-temperature superconductors, and semiconductors with large band-gap energies, incorporate light elements in crystal lattices at short interatomic distances.

"Seeing small atoms at atomic resolution has always been a challenge, because they don't strongly scatter the electrons in the microscope's beam," says Michael O'Keefe. "When the light atoms are close to heavy ones, it has been virtually impossible to resolve them. Heavy atoms scatter electrons much more, and as a result the interference pattern is just too complex to resolve."

The OAM had its genesis in the early 1990s, when NCEM's three-story, million-volt Atomic Resolution Microscope, or ARM, was the world's most powerful, with a practical resolution of 1.6 angstroms.

O'Keefe proposed a way to computer-process through-focus images to achieve higher resolution from a medium-voltage microscope, an approach first suggested in the late 1960s. "Such a microscope can be designed so that its 'information limit' — the limit to which it produces phase-scrambled information — lies well beyond its traditionally defined nominal resolution, with all the transferred information in phase," he explains.

"By combining information from many images, a single image with resolution approaching the information limit can be achieved in practice."

He adds, "The one angstrom barrier has been a Holy Grail for electron microscopists worldwide ... The OAM makes a truly extraordinary addition to Berkeley Lab's scientific 'toolbox,' and I can't wait to see what new discoveries it will bring for our users."

Philips expands soft ferrite core business

Philips Components' Advanced Ceramics & Modules (AC&M) business group has announced the official opening of a major extension to its wholly-owned Philips-Ferpol production plant for soft ferrite cores located at Skierniewice, Poland.

The Ferpol plant will manufacture ferrite cores on a 24 hour a day basis to serve global customers including Philips itself. Already the plant produces around 3 million ferrite cores per week and, although the majority of this output is currently utilized in Philips products, the management team at Ferpol intends to increase Philips' overall share of the soft ferrite market.

Philips is ranked number two in the world for soft ferrite production and number one in Europe, so the challenge for Philips is to become the single largest global producer.

Wandel & Goltermann announces name change

Wandel & Goltermann Pty. Ltd. have announced that they have changed the name of the company to Wavetek Wandel Goltermann Asia Pacific Pty. Ltd. The name change reflects the result of the merger between Wavetek and Wandel & Goltermann

Established in 1923 in Reutlingen, Germany, Wandel & Goltermann has had more than 50 years of experience in providing high quality test and measurement equipment for the global communications industry.

Dual headquarters will be maintained in Research Triangle Park, North Carolina, USA and in Eningen, Germany. The company focuses on serving the global communications sectors of Telecom Networks, Enterprise Networks, Wireless and Multimedia as well as the production of precision measurement instruments and handheld test tools.

Lucent delivers optical networking through the air

Using beams of light to transmit information directly through the air, a breakthrough optical networking system from Lucent Technologies will dramatically boost the capacity of local data networks and extend the reach of today's high-capacity fiber-optic systems.

Lucent's new WaveStar OpticAir system will use state-of-the-art lasers, amplifiers and receivers that can be placed on rooftops or in office windows to transmit voice, data or video traffic from point to point through the air. Designed by Bell Labs, the WaveStar OpticAir system will use dense wave division multiplexing (DWDM) technology to increase network capacity in metropolitan areas and campus environments where cost, geography or other constraints may make fibre connections impractical.

The first system to use DWDM technology directly through the air, Lucent's WaveStar OpticAir system eventually will enable business customers and service providers to transmit up to 10Gb/s between locations. That's 65 times more information than with today's radio frequencies.

"Lucent is committed to providing our customers with cutting-edge metro optical networking solutions — bringing photons not only to the desktop, but to rooftops, windows and ships at sea," said Gerry Butters, president of Lucent's Optical Networking Group. "By adding this breakthrough technology to our industry-leading portfolio, Lucent soon will be able to provide the power of fiber-optics just about anywhere — with or without the fibre."

For more information on Lucent's Optical Networking Group, visit its Web site at **http://www.lucent-optical.com**.

Siemens' broadband network for Australian Rail Access Corporation

The Rail Access Corporation (RAC) of Australia has chosen Siemens to supply its new broadband network, in a major move to upgrade its internal communication system. The project is valued at around $A18 million in the first year, plus support and network expansions in the following years.

The Rail Access Corporation owns the railway tracks, stations, signalling, telecommunications and other infrastructure, which is needed by the trains in New South Wales, host state for the Sydney Olympics 2000.

The new broadband network is designed to enable closed circuit television (CCTV) on all of the railway stations to ensure the safety of the users. Each station will have its own local area network, and each train line will have a central site for monitoring all of its associated stations. The Siemens network will carry primarily the CCTV information to the central monitoring sites.

ABA releases digital TV channel plans

The Australian Broadcasting Authority has released its first digital channel plans. The plans, for the Sydney, Newcastle, Wollongong, Brisbane, Toowoomba and Darwin television markets, set out the channels existing broadcasters will use for their digital transmissions from 1 January 2001.

"The ABA has developed these digital channel plans with the interests of viewers foremost in mind," said Professor David Flint, ABA Chairman. "The ABA has sought to minimise the number of changes that viewers will have to make to their existing reception equipment to receive digital broadcasts. By the same token, the ABA has sought to reduce costs to broadcasters by maximising their ability to use their existing transmission facilities."

The release of the plans is in accordance with the strict timetable the ABA has set itself in order for viewers in adjacent regional markets to make changes to their analog reception equipment.❖

SOLID STATE Update

LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

Web-addressable time & temp recorder

Dallas Semiconductor has announced the Thermochron iButton, claimed as the first single-chip time and temperature logging device that is submersible, dirt- and impact-resistant, and Internet-ready upon delivery.

Thermochron is supplied in a 16mm stainless steel iButton form factor,and is self-powered. It is said to surpass other time and temperature loggers for economy, durability and compactness.

Applications include in-container monitoring of temperature-sensitive goods such as frozen foods, fresh produce, chemicals, medical reagents and medical specimens like blood.

The Thermochron iButton integreates a thermometer, real-time clock, and memory for storing readings.

A user or service provider can set up a data logging mission using free software available at **www.iButton.com**. The mission specifies the time for the thermometer to first wake up and take a temperature reading, as well as how often, from once per minute to once every 255 minutes. The mission also sets flags for upper and lower temperature limits as well a real-time clock alarms.

The iButton receives instructions by pressing a Blue Dot receptor, which attaches to any existing PC. The Blue Dot, along with a connector for a serial, parallel, or (soon) a USB port, is available for US$15. In addition, hand-held computers available from a number of manufacturers have the Dot receptor built into the design. Digital packetized two-way communication with the iButton takes place by transmitting and receiving a one-wire signal through the steel case at up to 115.2k bits/second.

For more information contact Dallas Semiconductor, 4401 South Beltwood Parkway, Dallas TX 75244-3292.

Fast buffer amp for video driving

Burr-Brown's new OPA682 series (single, dual, triple) of high speed video buffer amplifiers provides high bandwidth (240MHz) and high slew rate (2100V/us) at a gain of +2, making them ideal for driving matched coax lines in video signal distribution. A fixed gain video line driver like the OPA682 delivers a wideband but precise gain of unity to matched loads, where signals must be transmitted between various pieces of video processing equipment.

Operating on a very low 6mA/channel supply current, the OPA682 series offers a slew rate and output power normally associated with a much higher supply current. A new output architecture delivers high output current with minimal headroom and crossover distortion for exceptional single supply operation. Using a single +5V supply, the series can deliver a 1V to 4V output swing with over 100mA drive current and 200MHz bandwidth.

System power may be further reduced by using an optional disable control pin. When the disable pin is pulled low, the supply current drops from 6mA to less than 300uA/channel.

The dual OPA2682 (two OPA682s on a single chip) can be used as a wideband differential receiver, providing buffered differential input/output — critical to maintaining signal integrity in electrically noisy environments. The triple-channel OPA3682 provides a significant reduction in board space with three line drivers in a small SSOP-16 package, matching up well with the signal distribution requirements of workstation graphics RGB.

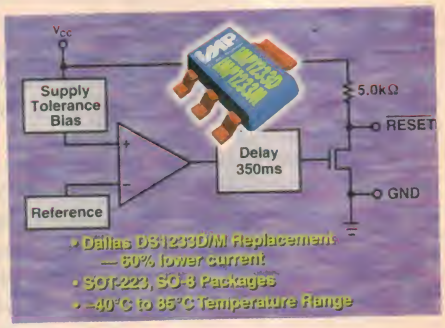
For more information contact Kenelec Scientific, 23 Redland Drive, Mitcham 3132.

Low power reset circuit for micros

IMP, Inc has developed an improved, low-power replacement for the Dallas Semiconductor DS1233D and DS1233M microprocessor reset circuits. Fabricated on IMP's advanced 0.8-micron CMOS process, the IMP1233D and IMP1233M have reduced operating current by 60%: 20uA for 5V operation and 15uA for 3.6V.

Applications include cellular phones, set-top boxes, PDAs, embedded control systems, printers and single board computers.

Threshold voltages are available for 5V, 3.3V and 3V systems. The IMP 1233 devices have an open-drain output structure with an on-chip pullup resistor. No external components are needed. An active-low reset signal is issued whenever the monitored supply voltage is below the reset threshold. After the supply voltage returns to an in-tolerance condition, the reset signal remains active for 350ms, allowing the power supply and system microprocessor to stabilize.



Devices are available in four-pin SOT-223 and eight-pin SO surface mount packages. Data sheets, samples and production quantities are available now.

For more information contact IMP Inc., 2830 N. First Street, San Jose CA 95134-2071 or visit their website (**www.impweb.com**).

High performance DSP motor controller

Analog Devices has announces what it claims is the world's highest performance mixed-signal embedded digital signal processor (DSP)-based motor controller. Optimized for industrial applications requiring high-performance processing power,

speed, flexibility and precision, the ADMC401 offers unmatched performance and chip-level integration.

The ADMC401 integrates ADI's 'work horse' DSP core, the ADSP-2171 — a 16-bit fixed point DSP, capable of processing up to 26 million instructions per second (MIPS). This is said to represent the highest processing power available for motor control today. The DSP is combined with ADI's high-resolution, simultaneous-sampling 12-bit, eight channel analog-to-digital converter and peripherals, all on one integrated circuit.

The new device is optimized for speed, precision and control of AC induction motors, permanent-magnet synchronous motors, brushless DC motors and switched reluctance motors, in industrial applications that demand the highest level of processing power. The chip architecture permits up to eight dedicated analog inputs to be converted in less than 2us through the high resolution 12-bit pipeline flash ADC. The signal-to-noise ratio (SNR) is greater than 70dB.

Other peripherals include the following: a 16-bit, three-phase pulse-width modulation unit to produce high-accuracy PWM signals with minimal processor overhead; a flexible encoder interface unit with programmable input filtering; 12 lines of programmable digital I/O; two auxiliary PWM outputs; a 16-bit watchdog timer; two 16-bit interval timers (one of which can be linked to the encoder interface unit); Power-On-Reset circuit; and a programmable interrupt controller that manages peripheral interrupts.

For more information contact Analog Devices, Suite 4/1621 Point Nepean Road, West Rosebud 3940.

Step-down charge pumps deliver 100mA

Linear Technology's new LTC1503-1.3 and LTC1503-2 are claimed as the industry's first regulated step-down charge pumps in 8-lead MSOP packages. The parts provide 100mA of output current at 1.8V or 2V, from a 2.4V to 6V input voltage.

The LTC1503 is up to 40% more efficient than a linear regulator, yet it requires just four capacitors and no inductor. This, combined with the LTC1503's low operating and shutdown current (25uA and 5uA, respectively) extends the operating time of battery-powered products without any increase in circuit size. The LTC1503 is claimed ideal for a broad range of space restricted devices such as cell phones, handheld computers and portable instruments.

The LTC1503-1.8 and LTC1503-2 include short-circuit and over-temperature protection and a shutdown feature that prevents battery drain by disconnecting the load from VIN in case of an inadvertent short on the output.

For more information contact REC Electronics, Unit 1, 38 South Street, Rydalmere 2116.

High-temp MOSFETs use logic level drive

Vishay Siliconix has added to the options available to automotive and desktop computer designers with seven new N-channel TrenchFET power MOSFETs for DC-DC conversion and motor control applications. The new devices combine a robust 175°C maximum junction temperature rating with guaranteed on-resistance specifications for 4.5V logic level gate drive operation, simplifying the microcontroller interface in desktop computer and automotive systems.

With a 30V breakdown voltage, the new SUB70N03-09P (D2PAK), SUP70N03-09P (TO-220), and SUD50N03-10P (DPAK) combine low on-resistance with reduced gate charge for maximum efficiency in DC-DC conversion applications over the full load range. For all three TrenchFETs, maxi-

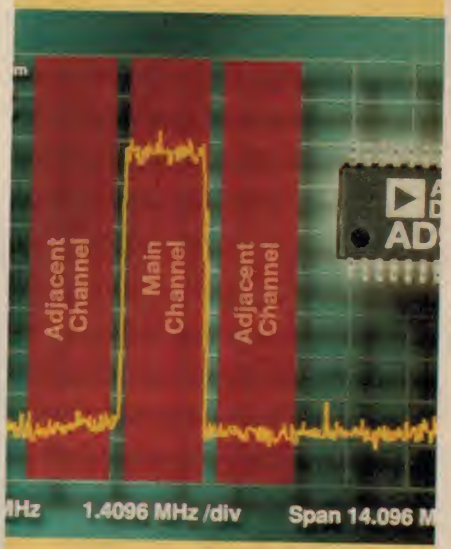
mum on-resistance is just 15mΩ for 4.5V gate drive while typical gate charge is just 45nC. Maximum current handling of 70A for the D2PAK and TO-220 devices, and 50A for the DPAK device, make these TrenchFETs a rugged option for desktop computer conversion applications as well as for controlling seat positioning, HVAC and other small motors in automotive systems.

For designs requiring the headroom of a higher breakdown voltage, the SUB75N06-12L (D2PAK) and SUP75N06-12L (TO-220) combine a maximum drain-source voltage of 60V with on-resistance of 12mΩ at a 10V gate drive. Maximum current handling for both devices is a full 75A. For cost-sensitive applications with lower headroom requirements, the new SUB45N03-13L (D2PAK) and SUP45N03-13L combine maximum on resistance of 13mΩ at 10V with a 30V breakdown voltage, with maximum current handling of 70A for both devices.

For more information contact Vishay Siliconix, 2201 Laurelwood Road, Santa Clara CA 95054.

Transmitting DACs for wideband CDMA

Analog Devices has released the AD9750 (10-bit), AD9752 (12-bit) and AD9754 (14-bit), described as the second generation of ADI's line of pin-compatible, transmit-quality digital-to-analog converters called TxDADs.



With a lower noise floor than the first generation of TxDACs (spurious-free dynamic range or 'SFDR' to Nyquist @5MHz output of the AD9754 is 83dBc) and improved dynamic range over a wider output bandwidth (AD9754 has -70dBc SFDR up to 15MHz), the new 125MS/s TxDACs will enable the next generation of communications systems such as emerging W-CDMA systems, multi-carrier base stations, software radios, xDSL modems and high-speed, high precision instrumentation.

The AD9750, AD9752, and AD9754 were designed in response to increasing demands by designers of wideband and multi-carrier applications. The AD9754, for example, improves Adjacent Channel Power Ratio (ACPR) performance required for wide-bandwidth communications systems that employ IMT2000 and other emerging high-capacity communication technologies. ACPR is defined as the ratio of the amount of power injected out of band by the inband information. Even with 100% channel loading the inband signal produced by the AD9754 results in an ACP of 70dB (with a bandwidth of 4.096MHz centred at 16.384MHz).

For more information contact Analog Devices, Suite 4/1621 Point Nepean Road, West Rosebud 3940. ❖

Handy Low Power UHF FM Transceivers

An interesting and very useful handheld UHF FM transceiver is now being sold by Dick Smith Electronics: the Digitor D-1099, a 20-channel unit which operates not on the congested UHF CB band, but in another part of the UHF band that has been shared for some time by a number of services, including radio amateurs. It's one of the first products to make use of the ACA's recently declared Class Licence for low power devices in that band.

BY JIM ROWE

SMALL HANDHELD transceivers or 'walkie-talkies' can be very handy for basic two-way communications, in quite a few familiar situations: feedback when you're up on the roof trying to optimise reception from the TV antenna; calling a family member for a meal or to meet unexpected visitors, when they're out walking the dog (or working in a remote paddock); maintaining communications between a group of people on a bushwalk or hike; or simply calling one of your kids back from a visit to neighbours...

Handheld CB transceivers working on the 27MHz (HF) and 476-477MHz (UHF) citizens' bands have been available for this sort of use for some time, of course. But both of these bands have become quite crowded, and also the transceivers designed for them have tended to become rather complex — a bit too elaborate when you really only want basic short-distance or 'line of sight' communication.

Luckily a couple of new bands have recently become available for this type of use, including a narrow band only 1.74MHz wide inside a much larger UHF band that has been shared for many years by services such as Radiolocation (the Primary user), the Department of Defence and radio amateurs (both Secondary users).

The band in question is from 433.050 to 434.790MHz, which was made available by the Australian Communications Authority a couple of years ago for low powered (20mW EIRP maximum) communications and control devices such as wireless data links, vehicle and building access remote controls, etc. It was declared under the ACA's 'Class Licence' system, which means that devices which meet the Class Licence requirements for that band can be sold and used without any individual licence or permit.

With a choice of 20 different channels and 38 CTCSS calling tones, there's quite a good chance you'll be able carry out uninterrupted communications, even if the band should become congested at some time in the future

Needless to say, the radio amateur users of this part of the spectrum were none too delighted when this new band was allocated, fearing that users of the new equipment might cause interference to their own established channels on those frequencies. But so far at least there don't seem to have been any significant problems — not surprising, because of the very low power limitation on the new Class Licence devices. Limited to only 20mW output, they're clearly only capable of short-range 'line of sight' use.

The new Digitor D-1099 handheld UHF FM Transceivers from Dick Smith Electronics seem to be one of the first — if not *the* first — handheld transceivers to become available in Australia for this new band. Compact (120 x 59 x 32mm) and quite light in weight (200g without batteries), they offer reliable and clear short-distance narrow band FM communication on a choice of 20 channels spaced at 25kHz intervals in the new band, from 433.750MHz to 434.225MHz inclusive.

Operating from four standard AA cells (either alkaline or NiCad), the transceivers deliver the maximum allowed output of

20mW EIRP — enough for about 1km of line-of-sight communication outdoors. And although they're very reasonably priced at only $149 each, they offer a number of nice features over and above the basic 'press to talk' (PTT) simplex mode two-way communication.

For example there's built-in squelch, to silence the receiver until a useful signal is being received — preventing user fatigue due to constant noise reception. You can cancel the squelch via a 'Moni' button if you're trying to receive very weak signals, but generally this shouldn't be necessary.

Taking advantage of the squelch and the D-1099's modern digital PLL circuitry, there's also a built-in channel scanning feature activated by pressing the 'Mode' button. In this mode the receiver section scans through the 20 channels cyclically, stopping only when a signal is found. Then you can stop the scanning by pressing either the Mode or Moni buttons, and begin communication on that channel if you wish.

Of course you can select any of the 20 channels manually at any time, using the 'Up' and 'Down' buttons.

Another very nice feature is built-in selective calling, using the CTCSS sub-audio tone calling system. Here you have a choice of some 38 different calling tones (from 67.0Hz to 250.3Hz), which are used to 'tag' the transmissions and make the receivers respond only to signals so identified. So by setting up your two or more transceivers to one particular tone out of the 38, you can have essentially 'private' communication — or at least not be made aware of any transmissions from others using the same channel.

With a choice of 20 different channels and 38 CTCSS calling tones, there's thus quite a good chance you'll be able carry out uninterrupted communications, even if the band should become congested at some time in the future.

Other handy features include a backlight for the small LCD display, for convenient night-time use; a selectable auto power-off function, which turns the D-1099 off automatically after about two hours of inactivity; a selectable 'keylock' function, whereby you can lock the channel select and Mode buttons, to prevent accidental switching off-channel or activation of scanning; built-in jacks for an external microphone and speaker/earphone; and a belt clip and carry strap supplied as standard, along with detailed user instructions.

By the way, DSE is also selling a matching 600mA/h NiCad battery pack for the D-1099 transceivers, along with the appropriate charger. These sell for $26.95 and $16.95 respectively, and would probably be a worthwhile investment for anyone likely to give the transceivers a fair bit of use. The transceivers have a small socket on the side to plug in the charger lead, for charging *in situ*.

I should also mention that the transceivers are quite solidly made, and are provided with captive rubber caps to seal the various jacks, etc. They appear to be capable of resisting a reasonable amount of dust, and possibly even a bit of moisture.

Trying them out

Dick Smith Electronics kindly made a couple of the new transceivers available for evaluation, and we were able to try them out in a typical suburban Sydney location (but near a busy main road).

We found them both convenient to use, and capable of clear and reliable short-distance communication. For example outdoors in a practical approximation of line-of-sight communications, we had no trouble achieving clear '5 and 9' type contacts over distances of up to 1km or so — even with a few trees and the odd house in between. Not bad for only 20 milliwatts!

During our testing we also set one of the transceivers operating in scanning mode for some hours, and basically didn't detect any recognisable messages on any of the channels during that time; just the odd radiolocation carrier, etc. This suggests that the 434MHz band is reasonably free from congestion, at least as yet.

In short, then, we found the Digitor D-1099 handhelds a very practical little communications tool. For anyone wanting reliable short-distance communication at low cost, and on a UHF band that's currently fairly free from clutter, they offer some nice features. ❖

Digitor 20-channel UHF FM Transceiver

Compact, reasonably priced handhelds for short-distance communications, using the recently established 434MHz Class Licence band.

***Good Points**: Provide clean, easy to use narrow-band FM communication within about 1km; low power ensures good battery life; choice of 20 channels and 38 CTCSS selective calling tones gives many options for reasonably 'private' communications.*

***Weak Points**: Nothing significant. Because the 434MHz band is shared with other services, though, communications may be subject to occasional interference.*

***RRP**: $149 each*

***Available**: Dick Smith Electronics stores (including PowerHouse stores) and dealers, or via DSE's Direct Link order line on 1300 366 644.*

Analogue Electronics CD-ROM

The latest in Mike Tooley's series of multimedia CD-ROMS covers the complicated topic of analogue electronics. Just about everything is covered here, from basic transistor operation through to amplifiers, oscillators and filters, and like its predecessors, it's all explained in a very interactive way.

BY GRAHAM CATTLEY

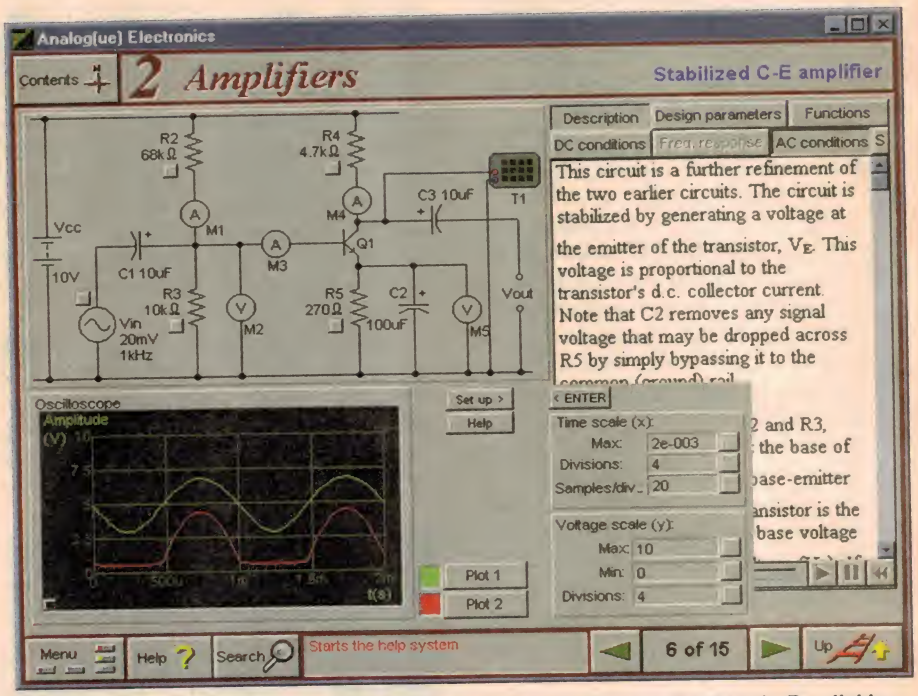
Last year I had the pleasure of reviewing the two previous CD-ROMs from Mike Tooley (Electronic Circuits and Components, and Digital Electronics) and so when I heard that the latest in the series was out, I was more than happy to give it a go.

It is hard to describe this series of CD-ROMs from Mike, as they are part on-line textbook, part teaching aid and part interactive circuit simulator. To call them by any one of these titles would do them an injustice, and so the rather general title of 'Interactive CD-ROM' is about the best I can come up with. What ever you call them, these CD-ROMs present the subjects in a clear concise manner, and offer a lot more than a simple textbook ever could.

The system requirements for installing Analogue Electronics are minimal, to say the least. A 486/25 with 12MB RAM and 10MB disk space are all that's needed, and it installs under any Windows operating system, from Win 3.1 up to Windows 95, 98 and NT. It is also available as a network installation, suitable for classrooms etc.

Sticking with the same navigation system as its two predecessors, the opening screen presents you with a column of buttons down the right hand side of the screen covering each of the topics, with a series of setup, help, search and exit buttons along the bottom of the screen.

The topics cover everything you'd expect, including op-amps, filters, oscillators, transistor amplifiers and analogue systems. Fundamentals is the place to start though, and this topic gives an explanation of analogue signals, transistor operation and the principles of waveshaping circuits (attenuators and filters). Each section is broken up into eight to ten 'pages', each containing a couple of paragraphs of explanatory text and an 'interactive' circuit diagram or waveform display.



I'd say that this is the next best thing to building a circuit up on the bench. By clicking on the buttons next to each resistor, you can select a new value, and see instantly the effect it will have on the circuit. Obviously I'm going to have to fix that base bias...

Pressing buttons

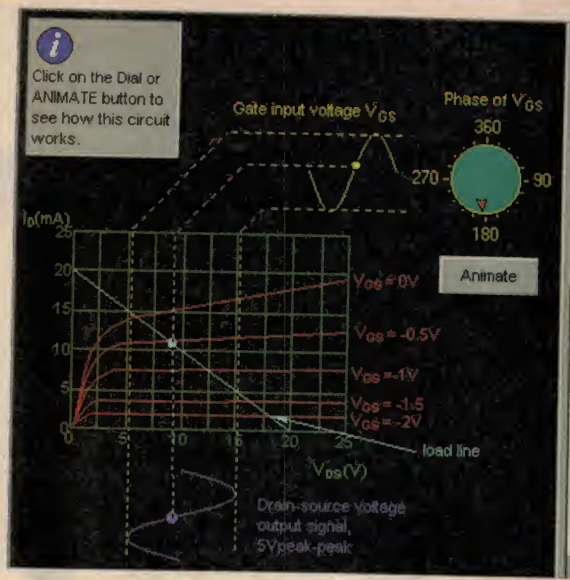
By interactive, I mean that you can use the mouse to click on sliders to change voltages, turn knobs to adjust phase and press buttons to alter component values. Most circuits feature an oscilloscope display showing the output waveforms or frequency response curves, as well as meter readouts giving measurements for DC conditions. This degree of circuit simulation is possible because a version of SPICE3F4 is built into the application. Despite the fact that the SPICE engine isn't automatically enabled, and the many warnings that it is all rather complicated, it's all pretty intuitive, and you can potter around adjusting voltages and tweaking values to see just how the circuit operates. As well as built-in circuit analysis, Analogue Electronics can also export its circuits to either Electronics Workbench or Crocodile Clips circuit simulation packages, so you can use these circuit simulation packages in conjunction with Analogue Electronics.

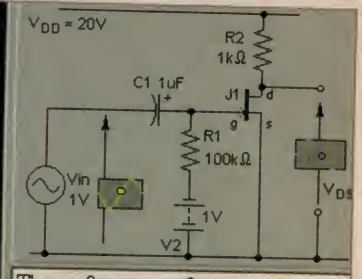
To help you keep some direction in your experimentation, a number of circuits come with assignment sheets that you can print out and work through, and they help to organise your work and ensure you understand the points being explained.

Web links

[http://www.emona.com.au]
[http://www.matrixmultimedia.co.uk]

Even something as abstract as load lines is explained simply and effectively. This is one of a few of the animated screens on the CD-ROM. Sit back and watch it run, or go and twiddle that large knob instead.





The performance of a common-source amplifier stage can be predicted by means of a *load line* superimposed on its output characteristic. The load line is constructed for a particular value of load resistance (R2 in the diagram). One end of the load line is the drain supply voltage (this is the value on

The text appearing on each screen is narrated (as with the previous CD-ROMS from Mike), and this makes the assimilation of the information much easier - if it is read aloud to you, you don't skip through the hard bits, and you can then concentrate on the formulas and diagrams displayed. In this sense, Analogue Electronics is better than a textbook, and with the various gadgets on just about all the featured circuits, you'll actually *enjoy* yourself.

The only slight drawback is the price. At $129, the software isn't exactly cheap, but in my mind, you'll get what you pay for: a $10 CD-ROM full of shareware electronic software might sound like a good deal, but you aren't going to learn an awful lot from it. If you buy Analogue Electronics, you *will* learn a lot, and you'll have a lot of fun while doing so.

If you'd like to see the quality of these CD-ROMs from Mike Tooley, take a look at the Emona website listed in the Web links box, where you can download demo versions of two of his earlier works, Digital Electronics and Electronic Circuits & Components.❖

Analog Electronics CD-ROM from Matrix Multimedia

A multimedia tutorial covering analogue fundamentals, through filters, oscillators, op-amps and analogue systems.

Good points: *Easy to install, works well, lots of stuff to play with, and it actually teaches you something about the subject too.*

Bad points: *None really, but the price is a bit on the high side.*

RRP: *$129*

Available*: Emona Instruments, 86 Parramatta Rd., Camperdown, NSW 2050. Phone: (02) 9519 3933, Fax (02) 9550 1378. Email testinst@emona.com.au.*

NEW PRODUCTS

Components & Equipment

Pinhole camera in PIR detector

New from Allthings Sales & Services is a concealed video camera for covert or discreet surveillance. The unobtrusive unit has the appearance of an ordinary alarm system detector and contains a fully functional PIR movement detector, concealed pinhole camera, microphone, preamplifier and timer-controller.

The CAM-BW 802 camera is suitable for normal light levels in homes, offices, showrooms, warehouses, shops, etc. The inbuilt dual-element pyroelectric movement detector and timer-controller may be used to control lights, alarms and a VCR, thereby eliminating unnecessary recordings. For 12V DC battery powered systems the camera can be powered via the timer-controller for a stand-by consumption of only 5mA.

Image quality is better than VHS and the microphone is a high-sensitivity electret with line level audio output.

The camera is supplied complete with swivel mounting bracket, screws and cable set with BNC video, RCA audio and 2.1mm DC sockets. An optional VCR Relay Kit can be used to easily modify a low-cost standard VCR for In-Alarm Event-Only Recording.

The CAM-BW 802 is priced from just $139.00 including tax. For more information contact Allthings Sales & Services, PO Box 25, Westminster 6061 or visit their website (**www.allthings.com.au**).

LAN-Cable tester with colour screen

Hewlett-Packard has announced the HP WireScope 350, claimed as the industry's first handheld colour-touch-screen-equipped tester that allows cabling contractors and IS managers to certify commercial cabling infrastructure to current and emerging local area networking (LAN) performance standards.

The tester provides a 350MHz test frequency range and measurement accuracy beyond the draft TIA level III specification, exceeding the expected requirements for Category 6/Class E cable certification testing. It also supports Telecommunications Industry Association (TIA) and International Organization for Standardization (ISO) test standards and draft specifications for Category 5 and 5E, and related LAN standards, including Gigabit Ethernet and asynchronous transfer mode (ATM).

The WireScope 350 user interface features a large colour touch-screen for simplified menu navigation and improved results comprehension. Colour diagrams highlight fault sources, and cabling colour codes are designed to improve operator efficiency and reduce training requirements.

The HP WireScope 350 test kit is expected to be available by next US fall through authorized HP WireScope distributors and resellers worldwide, priced at US$5995.

For more information on the HP WireScope 350 cabling test kit visit the dedicated website at **http://www.wirescope.com**.

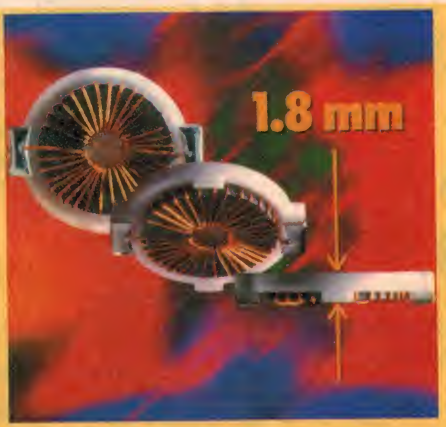
High power laser beam sensors

Banner Engineering's PicoDot polarized retroreflective Class 2 laser sensors are extremely compact, lightweight and self-contained, designed for precision sensing at both close and long ranges. They're claimed ideal for applications where high power and narrow beam precision are crucial, including wafer handling, small parts sensing, and precision long range sensing

Low profile 'Power Wafer' inductors

Coilcraft has introduced the first of its new line of 'Power Wafer' magnetics. The ultra-thin, high performance power inductors are designed for handheld electronic devices, Type 1 PC cards, disk drives and other low profile power applications.

The new LPT3305 Series is a toroidal inductor in a ceramic case just 1.8mm high. Not only is its height exceptionally low, but its 8.9 x 10.2mm footprint takes up 25% less board space than



competitive low profile inductors. Toroidal construction keeps stray EMI to a minimum.

The LPT 3305 Series is available in 11 inductance values from 1uH to 47uH. Saturation current ratings range up to 6A, with RMS current ratings up to 1.6A. To help engineers in their circuit modelling, PSPICE models of the LPT3305 Series are available on the web (**www.coilcraft.com**) or Coilcraft's CD-ROM catalog.

For more information contact Tri Components on (03) 9560 2112 or at **www.tricomponents.com.au**.

applications. They are also well suited for high-speed presence detection or counting applications, due to their 0.2ms sensing response time and 50us repeatability.

Using a visible red laser beam and equipped with a special polarizing lens, PicoDot sensors provide exceptional accuracy at ranges up to 39.6m (130ft), allowing them to replace opposed-mode laser-based photoelectrics in long range sensing applications. And measuring only 40.6 x 12.7 x 45.6mm, with a less than one ounce weight, they fit and function in smaller spaces than many photoelectrics, including robot arms and end effectors. They are also easier to apply because only one sensor has to be wired, saving on installed cost and maintenance.

Green and yellow LED indicators on the sensors provide constant operating status information. The green LED indicates POWER ON, and flashes to indicate output overload. The yellow LED indicates LIGHT SENSED, and flashes to indicate marginal sensing conditions (low excess gain) in light condition.

PicoDot supply voltage is 10 - 30V DC (10% maximum ripple) at less than 20mA. Protective circuitry guards against reverse-polarity, over voltage and transient voltages. The output configuration includes an SPDT (complementary) solid-state switch with a choice of NPN (sinking) or PNP (sourcing) outputs, each capable of switching up to a 150mA load, and a choice of light operate (NO) or dark operate (NC).

For more information contact Micromax, 307 Kiera Street, Wollongong 2500.

Universal programmer

The System General ALLWriter Universal Programmer is described as an affordable solution for engineering applications. Reliable and cost effective, it features an embedded CPU/RAM/power supply for certified algorithm programming plus universal converters for virtually all devices, and comes with comprehensive device and package support.

Internal RAM is 32Mb standard, expandable up to 512Mb. The high speed RS-232C serial I/O interface can operate at up to 230kb/s, for fast and efficient operation. Also included is an IEEE 1284 high speed parallel interface. The inbuilt switchmode power supply is suitable for 110V or 220V mains voltage.

Devices supported include EPROM, EEPROM, Flash EPROM, PALs, GALs, PEEL, EPLD, EEPLD, AMD/Vantis MACH, Altera MAX5000/7000 and Xilinx 95XXX EPLD.

For more information contact Nucleus Computer Services, 9b Morton Avenue, Carnegie 3163 or visit their website (**www.nucleuscomputer.com.au/SG/pricelist.htm**). ❖

New Books

Electrical Servicing

ELECTRONIC AND ELECTRONIC SERVICING, by Ian Sinclair and Geoff Lewis. Published by Butterworth-Heinemann (Newnes imprint), 1999. Soft covers, 190 x 245mm, 310 pages. ISBN 0-7506-4434-6. RRP $47.95.

Another book by Ian Sinclair and Geoff Lewis, and from its title you would be forgiven for thinking that it covers the servicing of electrical and electronic equipment. It doesn't - on closer inspection this book reveals its true identity as a standard first-year text, covering Ohm's law, resistor colour codes, digital logic and so on.

To its credit, it does cover areas related to the servicing industry, with instructions on lifting heavy boxes, how to wire a mains plug and which fire extinguisher to use, but there is an underlying problem to Australian readers. The book has been written to suit the British National Vocational Qualification from the City & Guilds, and as such, a lot of the information isn't relevant in Australia - fire extinguishers are different colours here, the mains wiring is different, as are the safety regulations.

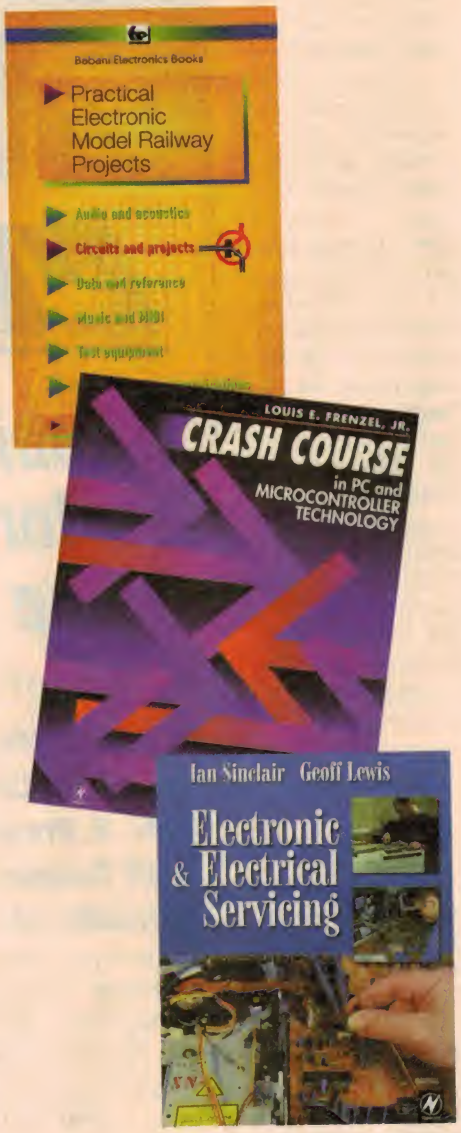
This, coupled with the poor production quality of just about all the diagrams in the book, and the sprinkling of typos throughout the text, mean that I can't really recommend it for Australian students. You'd be much better off spending your money on a textbook written for Australian TAFE subjects, a number of which we have reviewed in the past. (G.C)

Railway projects

PRACTICAL ELECTRONIC MODEL RAILWAY PROJECTS, by R.A. Penfold. Published by Bernard Babani, 1996. Soft cover, 111 x 177mm, 151 pages. ISBN 0-85934-384-7. Recommended retail price $14.95.

There are quite a number of Babani books around, each characterised by a low cost and a pretty good production. This book has both these qualities, and sets out to provide a number of useful but reasonably simple electronic projects that can be built using readily available parts.

The projects in the book include a range of controllers (or power supplies), including constant voltage, pulsed, pushbutton pulsed, and a pulsed controller with simulated inertia, momentum and braking. Other projects include automatic signals, steam whistle sound effect, two-tone horn sound effect, automatic two-tone horn effect and an automatic chuffer. Strip-board layouts and wiring diagrams are provided for all these projects, which are presented in the first two chapters.



Using a PC as the basis of controllers and signalling systems is covered in the remaining chapter, which according to the author, is not intended for beginners. However, as the author points out, using a computer with a model railway is a very interesting avenue to pursue.

Details of a PC parallel port are given, along with a description of how to use this port in a program. There are a number of small BASIC program listings in the book, as well as various circuits that are intended to be driven by the parallel port. These include LED drivers, pulse stretchers and various parts of a train controller, such as a digital to analog converter, an amplifier and a relay driver circuit.

The writing style is friendly, and there are quite a few diagrams and circuits, as well as the aforementioned BASIC program listings. It should be useful for anyone into model railways, and as the circuits are all relatively simple, the book is suitable for beginners. The review copy came from Jaycar Electronics, and should be available from your local Jaycar store, catalog number BB7054. (P.P.)

Micro tutorial

CRASH COURSE IN PC AND MICROCONTROLLER TECHNOLOGY, by Louis E. Frenzel Jr. Published by Butterworth Heinemann (Newnes imprint), 1999. Soft cover, 216 x 280mm, 286 pages, includes floppy disk. ISBN 0-7506-9710-5. Recommended retail price $75.00.

This is the latest of three Crash Course books by Louis Frenzel, which give the reader an intensive cram session on the subject involved. The subject of personal computers and microcontrollers is huge though, and so this book attempts to cover everything from binary maths and BASIC programming through to CPU architecture and assembly language in under 300 pages.

It does it though, because instead of the usual chapter-by-chapter arrangement of presenting this rather diverse topic, Louis has broken the material down into a large number of 'frames' each a couple of paragraphs long. At the end of each frame, there is a single multiple choice question that is answered at the beginning of the next frame, and the subject of the question is then expanded upon. This is perhaps the extreme in programmed learning, as you are effectively tested once every paragraph or so.

This system has its advantages; if you are reasonably familiar with the topic, you can easily skim along until you have trouble with one of the questions and then start reading more intently. It also highlights the topics that you have difficulty with, and so indicates the areas where you should concentrate your studies.

It is worth noting that this book has 'Crash Course' in its front cover for a good reason. This isn't a hold-you-by-the-hand textbook that teaches everything from first principals; it's more a whirlwind tour of everything you need to know before going to that job interview.

With the review questions every step of the way, and more on the included floppy, the whole thing works very well. I'd recommend it to anyone who has forgotten all they knew about micros, or those facing their final exams. (G.C.) ❖

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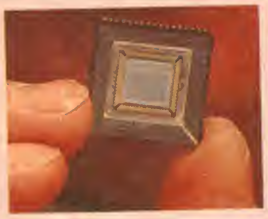


Silicon Valley Newsletter

HP, UCLA develop single-molecule switch

A TEAM OF researchers from Hewlett-Packard, working in cooperation with the University of California at Los Angeles (UCLA) have developed a functioning electronic switch from a single molecule, a development they hope will lead to microprocessors the size of a grain of salt — or smaller — with the computational power of today's mainframes and supercomputers.

The development of a single-molecule switch is a major step towards the development of a new generation of so-called 'chemically assembled electronic nanocomputers' (CAENs). The HP-UCLA work was reported in the *American Journal of Science*.

The next phase in the research is to use a series of the CAEN switches to built a prototype electronic circuit, an accomplishment the researchers believe they will be able to achieve by 2002.

The switch uses a single layer of a Y-shaped molecule of a substance called 'rotaxane'. The molecule is uniquely suited to function as a switch due to a ring-shaped band of electrons located on one of the two arms of the Y. In the 'on' or charged position, the ring is located at the top of the arm, while in the discharged 'off' position it is near the bottom where the two arms meet.

The roxatane film sits sandwiched between a lattice of tiny metal ground and charged wires running perpendicular to each other. The on-and-off positions of the ring can be detected by the current flowing through the lattice. Current only flows from the charged to the ground wire when the ring is in the top (charged) position.

Commercial application of the technology is easily a decade away. Building one or a few functional circuits will be relatively simple compared to building large complex designs and producing them reliably in large volume. But the researchers believe they are on their way to accomplishing that.

"We now have a clear line of sight", said James Heath, a member of the UCLA team of scientists, who said the team has already begun on the next phase in which they hope to build a functioning circuit capable of performing simple mathematical calculations. The circuit, with about five logic gates, measures only 0.2 micron in overall size.

One of the challenges to overcome is to engineer the switches in such as way that they can be switched on and off repeatedly, such as in traditional DRAM memory chips and microprocessors. The first CAEN switch is a read-only type.

Portable iMac has wireless 'net access

EYE CATCHING, INNOVATIVE. Those concepts have been a common characteristic in most of Apple Computer's major new products over the years, and the new portable iMac introduced at the MacWorld Expo in New York lives up to that tradition, with its rounded shapes and built-in wireless Internet access. The new iBook portable is priced at US$1599, weighs six pounds and is sold in two translucent colors — blueberry and tangerine — as well as in white.

"Customers wanted an iMac to go", said Apple's acting CEO Steve Jobs. "There has never been a portable designed for the consumer market."

Clearly the iBook builds on the phenomenal success of the iMac, of which some two million units will have been shipped by August 15, the first anniversary of the system. "iMac is going gangbusters", Jobs said.

Jobs said that the iMac's success proves that the PC market's high growth era is not over, as many analysts have suggested in the past year. "The PC era is in its infancy. I can see why people in the PC industry would say that, because the rate of innovation has gone to zero! We see this as a tremendous opportunity to improve the way PCs work. I hope people are starting to see design is 'making a difference' in computers."

The iBook will be available in September, well in time to catch some of the back-to-school education market, as Apple is targeting both consumers and schools with the new notebook. Apple will ship as many as 50,000 iBooks this quarter and 150,000 in the December quarter, which could add as much as US$100 million in revenue.

The iBook is the first portable designed with built-in wireless capability that allows users to move up to 150 feet from a base station while remaining connected to the Internet at 56kb/s. That covers most home and classroom situations.

The iBook's antenna runs around the system's 12" active-matrix screen. The iBook provides wireless Internet access via AirPort, a specially designed wireless link to local computer networks.

Lucent Technologies' Bell Labs Researchers Jinendra Ranka (L) and Robert Windeler have invented a novel optical fibre which converts a single light wavelength into all the colours of the rainbow — as it travels through the fibre. Here they use two of the fibres in experiments, generating light that is tightly confined to a narrow beam in each fibre's core, which is surrounded by a glass microstructure with air holes that cause unusual dispersal and low loss. (Business Wire)

Apple has worked with Lucent Technologies for about 18 months to develop the wireless technology. The AirPort requires a wireless networking card (US$99) that fits in a slot under the keyboard and a base station that looks like a space ship, which costs an additional $299. Ten iBooks can share one base station and they can be as far away as 150 feet, such as in a home or classroom.

The iBook has a carrying handle so it doesn't need a carrying case, a full-sized keyboard, a 300MHz PowerPC G3 processor, a built-in CD-ROM, a 3.2GB hard disk drive, a 56K modem and other features. Battery life is about six hours.

During a demonstration of the machine's wireless capability, Jobs typed in a Web site on the iBook and carried the notebook across the stage, drawing cheers as the audience realized there were no wires. Jobs brought out a hula hoop and encircled the iBook to ensure everyone got the point.

New software helps shrink chips

AT US$400,000 IT easily ranks in the top 1% of most costliest software packages. But Numerical Technologies' *iN-Phase* software performs one of the most amazing technology tricks to have come along in chip making. When integrated with some of the leading-edge lithography systems, the software allows chipmakers to shrink a 0.25 micron circuit to one with gate features as small as 0.09um, a quantum leap of immense proportions by chip industry standards. Literally these dimensions are four generations ahead of the state-of-the-art in chip production.

The software converts IC design automation files and automatically configures the layouts using a so-called 'phase-shifting' technology, to create photomasks that produce chips with gate lengths that are a factor of three times smaller than what today's state-of-the-art 248nm lithography tools are supposed to be capable of producing.

Already the NumeriTech software has been used by Motorola to shrink the gates of its PowerPC processor. Motorola will use the phase-shift technology to dramatically shrink the PowerPC chip to make it more suitable for mobile computing and communications devices. Other customers include heavyweights such as Lucent, Taiwan Semiconductor Manufacturing Co., UMC Group and VLSI Technology. All intend to deploy the technology in their fabs during the next 12 months.

"For companies focused on high performance chips such as microprocessors, DSPs, graphics ICs and networking chips, iN-Phase offers a way to achieve the performance benefits of next-generation IC feature sizes on today's processes," said Buno Pati, president and CEO of NumeriTech. "For the first time, these companies have an automated solution to access phase-shifted processes and produce 0.12 micron and below."

Analysts are impressed with the technology. "With the automation of phase-shifting, Numerical Technologies has provided a catalyst to allow semiconductor manufacturers a path to an accelerated technology roadmap", said analyst Dan Hutcheson, president of VLSI Research in San Jose.

AMD announces loss, Atiq Raza departs

ADVANCED MICRO DEVICES has announced a large quarterly loss, along with the resignation of its president and chief operating officer Dr Atiq Raza. But AMD vowed it is on the come-back trail, and will produce one million new K7 processors that outperform anything Intel has on the market today.

Raza cited personal reasons for his resignation. "My decision to leave AMD was a difficult one. I have enjoyed the challenges of helping to restore competition in the microprocessor market." But as COO, Raza has been held accountable for AMD's failure to produce its processors economically, causing the firm to experience severe financial difficulty despite unprecedented popularity of its microprocessor chips.

AMD reported a loss of US$162 million for the three months ended June 27, less than had been expected. A year ago, AMD lost $64.6 million. Thanks to a $259 million profit on the sale of its Vantis subsidiary, AMD recorded net income of $79.9 million. Sales totaled $595 million, up from $526 million in the year-ago period.

"In the face of Intel's intensifying aggression in the consumer sector of the PC market, where our AMD-K6-2 processor family has achieved substantial market share in both desktop and portable PCs, further gains in unit market share or revenue growth are unlikely", said AMD chief Jerry Sanders. "The key to resuming growth and expanding margins is the recently introduced AMD Athlon processor."

The Athlon K7 chip is the industry's first seventh-generation processor. Initial shipments of Athlon processors, including 600MHz versions, began in June. Sanders said he was confident the company could make more than one million of the Athlon processors in the fourth quarter.

Raza's resignation didn't surprise analysts, even though Raza had been listed as the heir apparent to Sanders. Raza joined AMD as part of the merger with NexGen.

"I deeply appreciate Atiq's many achievements and wish him well", Sanders said, adding that he himself will become acting COO, president and chief technical officer. This has set up a bizarre situation, because it means Sanders will have to manage the battle with Intel almost single-handedly over the next several years. Some believe that is exactly what Sanders wants, as the legendary Silicon Valley chip executive sees the coming battle as the defining moment of his career — which is nearing an end. ❖

HP selects top woman exec as CEO

THERE HAD BEEN speculation that Hewlett-Packard might pick an outside person to become its new CEO. There was even some talk about the company naming a woman. But the company has surprised the industry by doing both, announcing that Carleton ('Carly') Fiorina had accepted the position of President and CEO of the world's second largest computer manufacturer.

Fiorina is the now former head of Lucent Technologies' Global Services Division. She is 44 years old and will be only the third woman to head a Fortune 500 company.

In all, more than 100 candidates were interviewed for the job, which became available when current CEO and chairman Lewis Platt announced his plans to retire. Platt will remain chairman until December 31, when HP executive and board member Richard Hackborn will take over as chairman. Reportedly, Fiorina was Hackborn's personal top choice for the new CEO position.

Analysts also acknowledged the strategic significance in the Fiorina appointment. At a time when the distinction between computer, networking and telecommunications markets is blurring, HP the computer maker needs a leader with a sound understanding of networking and telecommunications technologies.

"The coming together of network communications and computer systems is accelerating and is going to be increasingly important. We think the fact that she comes from the telecommunications industry will be a tremendous plus for us. She is by far the strongest candidate we had for the job", said Platt in introducing the new HP leader.

Fiorina comes to HP after heading Lucent operations that generate $20 billion in sales. She worked her way to that position, holding an undergraduate degree in medieval history and philosophy from Stanford University and a master's degree in business administration from MIT.

She is said to be bright, articulate, ambitious and persistent with an appreciation for detail. Her management style is described as demanding, but she gets along well with people she manages. "She can see a situation, call it, come up with a solution, express that solution clearly and compellingly and rally people around it", said Kathy Fitzgerald, a senior VP at Lucent who worked under Fiorina.

COMPUTER NEWS & New Products

Flexible new imaging platform

Matrox Imaging has announced a new cost-effective PC based imaging platform for machine vision, medical imaging, video surveillance and embedded applications. Matrox 4Sight is a compact, self-contained platform with the core functionality needed for factory floor assembly and inspection systems, endoscopy machines, security systems and many other applications that rely on or can be improved by using digital imaging technology and computer based vision.

Image capture, processing and display, along with networking and general purpose I/O, are all integrated into a small, cost-effective package that has a footprint measuring only 208 x 184mm.

Matrox 4Sight uses PC technology to offer high performance without a high price. An Intel x86 compatible processor with MMX technology and PCI peripheral bus are just some of the components adapted from the PC world and featured on Matrox 4Sight. Other PC technology in the powerful imaging platform includes built-in hardware support for IEEE 1394.

Matrox 4Sight runs Microsoft Windows NT Embedded and Microsoft Windows CE, providing small, robust and deterministic OS support. The field-proven, award-winning Matrox Imaging Library (MIL) toolkit enables OEMs and system integrators to rapidly create next-generation vision systems based on the Matrox 4Sight platform. Matrox 4Sight is also compatible with DOS, Microsoft Windows 98 and Microsoft Windows NT.

For more information contact The Dindima Group, 10 Argent Place, Ringwood 3134 or phone (03) 9873 4455.

Print labels on lasers or inkjets

Brady's Laser and Injet Labels are designed to meet the needs of companies who do not have the budget to purchase a thermal transfer printing system. The labels allow an existing laser or inkjet printer to produce high quality labels — quickly, easily and efficiently.

The range includes labels for electrical, electronics, telecommuncations, data and general industrial use, suitable for laser or inkjet printers and in a material that will satisfy the most demanding applications.

Inkjet printing offers high resolution and the economy and print durability of dot matrix technology. The inkjet image penetrates the material surface, leaving it much more resistant to abrasion and harsh solvents than a toner based layer image. Inkjet printing also produces a level or detail that approaches laser quality. Brady's inkjet labels were specially developed for use with Hewlett-Packard inkjet printers, and can be used with the HP Deskjet 500, 600, 660, 850, 1200 and 1600 with the original manufacturer's ink.

High resolution laser printing makes it possible to generate readable, dense bar codes on labels small enough to fit into limited application space. Laser labels are also available in half-A4 sheets to eliminate wastage for low volume users.

The range includes self-laminating vinyl labels for wire and cable identification, metallised polyester for rating plates, circuit board and component labels, terminal block and face plate labels, asset and product identification labels and A4 label sheets for engineers drawings.

For more information contact Brady's Customer Service Department on 1800 620 816.

Redundant switch for server UPSs

American Power Conversion (APC) has announced its Redundant Switch, a cost-effective solution to provide fault tolerance and high availability for small to medium businesses. Designed for Microsoft Windows NT, Novell NetWare and Sun Solaris environments, the device uses a simple switching architecture to provide maximum power availability with a proactive, redundant source of back-up power.

The Redundant Switch works in association with APC's Smart-UPS range of uninterruptible power supplies (UPS). It is available as an independent solution, offering greater flexibility to work with a broader range of existing APC Smart-UPS. The Redundant Switch family is made up of two models, ranging from 1400VA to 3000VA.

Requiring only 1U of rack space, the Redundant Switch monitors the power quality from two UPSs, one primary and one redundant, each of which can be plugged into separate AC circuits. It automatically switches the load to the redundant Smart-UPS when it detects a potential disruption to the load, such as during a power spike or battery replacement. In addition it also communicates UPS status and alarm messages to 'PowerChute plus' UPS management software, which in turn alerts IT professionals that it detected a problem and proactively switched to the redundant UPS.

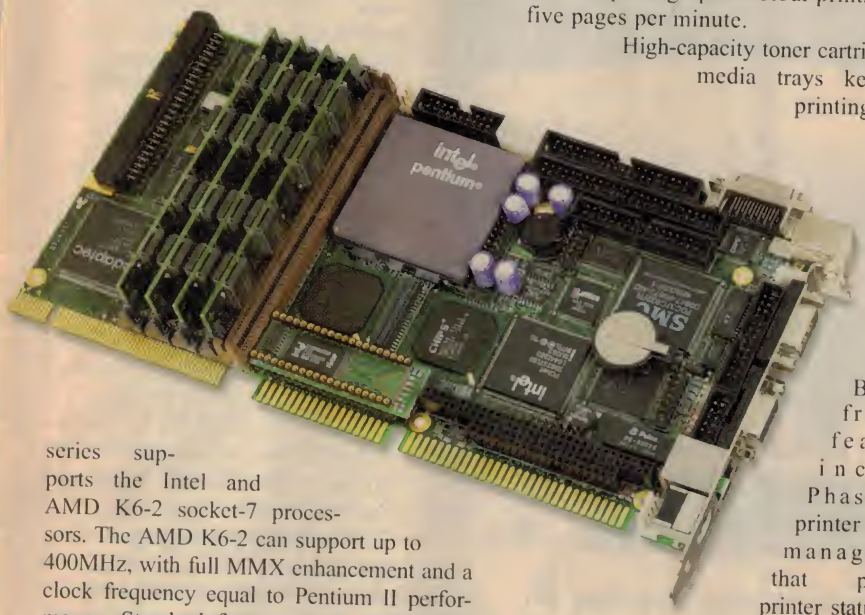
This additional layer of protection ensures the server is protected by a mirrored UPS configuration, extending redun-

dancy into power protection for mission-critical operations.

For more information contact APC on (02) 9955 9366 or visit their web site (**www.apcc.com/australia**).

Powerful half-size and PIGMG SBCs

The new 686LCD series single board computers from Inside Technology set a new benchmark in half-size SBC and PIGMG standards.



The series supports the Intel and AMD K6-2 socket-7 processors. The AMD K6-2 can support up to 400MHz, with full MMX enhancement and a clock frequency equal to Pentium II performance. Standard features on board include SVGA (CRT and LCD interfacing), 10MB Base-T Ethernet, USB, Panellink, up to 128MB of DRAM (512MB on the 686LCD/MG board), YUV direct video input, IrDA, SCSI-III (686LCD/MG only), DiskOnChip, two serial ports, a parallel port, and PC/104. It also incorporates the latest monitoring techniques, offering processor temperature and fan supervision.

The power supply on-board is a +5V supply which includes a DC/DC converter with a supply range of +3.3V to +12V.

The 686LCD series supports all popular operating systems such as MSDOS, Win3.xx, Win 95/98, NT, CE, OS2, AMX, QNX, Linux, Vxworks and PSOS.

For more information contact Baltec Systems, (07) 3356 8111 or e-mail to **sales@baltec.com.au**.

Colour laser has a B&W price

Designed to put colour printing on the business agenda, Tektronix Australia's Phaser 740L printer is a colour-capable workgroup laser printer at a breakthrough price of $2995.

The Phaser 740L colour-capable laser printer is a full-featured workgroup printer that allows customers to start with high performance black-and-white printing, then transfer to colour at any time simply by adding a colour cartridge for $1000. With 16 pages per minute black-and-white and a standard 10BaseT Ethernet (interface), the printer handles a range of typical business documents, from labels to reports and presentations. When colour enabled, it delivers photographic colour prints at up to five pages per minute.

High-capacity toner cartridges and media trays keep jobs printing longer without interruption.

Business-friendly features include Phaserlink printer job management that provides printer status, configuration, email notification of printer status, intranet support, and Tektronix support via standard Web browsers. Adobe Postscript 3 language and PCL language assure compatible access to networks, computer platforms and applications.

For more information contact Tektronix' Colour Printing and Imaging Division, on (02) 9888 0100.

Entry level 17" monitor

Hitachi Australia's new CM-640 17" monitor features the company's new Super High Contast (SHC) screen technology. With a maximum resolution of 1280 x 1024 pixels at 67Hz refresh rate and a viewable area of 15.9", the monitor is attractively featured and priced for home office users, or for office users wanting to upgrade from 15" monitors for quality desktop publishing, word processing or spreadsheet work.

The CM-640 is claimed ideal for first-time graphics users or those wanting the maximum brightness and resolution for their web browsing or gaming. Most users will take advantage of the unit's high 85Hz refresh rate at the ideal 17" resolution of 1024 x 768.

This is the first time that Hitachi's SHC technology, developed for high-end 19" and 21" screens, has been used in an entry-level product. The company says that this feature, when married with advances in focus, beam and flat-screen technology, ensures that the CM-640 user enjoys stunning images.

Users are also treated to advanced digital controls, with easy to use On-Screen setup and the latest advances in ergonomics and power saving technology, plus the latest Microsoft Plug and Play compatibility.

The Hitachi CM-640 measures 412mm x 402mm x 414mm and weighs 17kg. It is available from dealers around Australia at an RRP of $695 inc tax, complete with a three-year on-site warranty.

For more information contact Hitachi Australia, 13-15 Lyon Park Road, North Ryde 2113 or visit their web site (**www.hitachi.com.au**).

Disk drives with 50GB capacity

Simms International is the first distributor in Australia to offer the world's first 50-gigabyte disk drives from MetaStor Storage Solutions (part of LSI Logic). Simms are selling the 50GB drives on to resellers in 0.5-terrabyte RAID solutions, at a →

special offer based on 10 x 50GB disk drives. Resellers then have the option of selling them on in the same configuration, or breaking them down to match the configuration of their customers.

From drives to controllers to enclosure componentry, MetaStor storage systems employ a modular design enabling incremental growth or modification to systems as and when they are needed. Deployment options range from 18GB to 1.8TB per 72" cabinet, depending on the system, and all MetaStor systems support 4, 9, 18, 36 and now 50GB drives.

For more information contact Simms International on (02) 8912 3030.

High performance 1440dpi Bubble Jet

Canon has released the high-speed BJC-6000, a new generation Bubble Jet printer for the home and business market with six-colour photo printing and new black ink technology for crisp laser-like test. Featuring bi-directional printing, a twin cartridge system with separate ink tanks for each colour and high resolution 1440dpi quality, Canon claims the BJC-6000 has raised the standard for colour printing.

The BJC-6000 also offers the convenience of USB connection, with an optional USB adaptor kit retailing for $129. This delivers Macintosh compatibility for the iMac and PowerMacintosh G3 with operating system 8.1 or later. Windows 98 uses will also benefit from USB plug and play connection, with fast data transfer rates and multiple device connection.

The speed advantage of the BJC-6000 is due to a new technique of bi-directional printing and Canon's existing Drop Modulation Technology. Speeds of up to 8ppm for black text and up to 5ppm for colour can be achieved at a high resolution of 1440 x 720dpi. Bi-directional printing allows the resident twin cartridges to print continually, as the print head moves in both directions across the page rather than in the conventional uni-directional system where printing is only from left to right.

Drop Modulation Technology has been introduced, for the first time, within a black cartridge to achieve a sharper text. Working in unison with Canon's new black pigment ink the resulting text is blacker, laser crisp and has improved water resistance.

The BJC-6000 has an in-built sheet feeder for up to 130 sheets of media weights from 64-105 gsm, manual feed can handle up to 550gsm. Media includes plain, transparency film envelopes, high resolution, glossy photo paper, high gloss photo and back print film as well as fabric sheets, T-shirt transfers and banner paper.

The Canon BJC-6000 is available now from Canon dealers and selected retail stores and has an RRP of $549. For more information contact Canon Australia on (02) 9805 2000.

Dual-stream MPEG-2 video editing solution

Lako Vision has announced the Australian release of miroVIDEO DC1000, a dual stream, real-time digital video and audio editing solution based on MPEG-2 technology but priced under $5000.

Claimed as the most advanced digital video editing solution in the Australian market, the miroVIDEO DC1000 is capable of real-time processing of titles and transitions, and provides more than 300 real-time effects. It provides hardware performance based on the latest MPEG-2 technology, and comes with an unparalleled software bundle including Adobe Premiere RT 5.1, Pinnacle Systems' TitleDeko titling software, Pixilan Software's Video SpiceRack effects and Sonic Foundry's ACID Music software.

The DC1000 can use analog or DV (optional) video and can output directly to DVD.

"The DC1000 is the first MPEG-2 editing solution to hit Australian shores for under $5000. No other solution on the market compares to the DC1000, nor does any other card offer the power of dual-stream real-time effects for the same price range. The DC1000 will also pioneer non-linear video editing systems, with MPEG-2 file format set as the new international standard for broadcast video format", says Evan Kourambas, Lako Vision MD.

DC1000 takes advantage of storage efficient IPPP encoding of MPEG-2 video. Its design allows the user to edit MPEG-2 videos frame-by-frame even within compressed groups of pictures. The MPEG-2 encoding system is based on the 4:2:2 P@ML standard, specifically designed for broadcast quality video editing.

MiroVIDEO DC1000 is available from Lako Vision for an RRP of $4999, and is compatible with Windows 95/98 and Windows NT. For more information contact Lako Vision, Suite 2, 3 Wellington Street, Kew 3101 or visit their website (**www.lako-vision.com.au**).❖

Webwatch

BY GRAHAM CATTLEY

Due to popular request, I've collated a list of all the sites ever covered in Webwatch, and it is available for download from both our web site and our BBS in the Internet files section. You can save the file on your own system, and use it as a handy reference, and download the update every month. And if you know of any sites that you feel deserve a mention in Webwatch, drop me a line at grahamc@fpc.com.au, and I'll be happy to include it in an upcoming column.

AS I'VE SAID BEFORE, I usually refrain from covering computer related sites in Webwatch, and try instead to concentrate on sites of a more electronic nature. From time to time though, I'll make an exception — particularly if the site in question is of a more technical nature (or if I happen to like it — this is, after all, my column...).

Okay, here it is: **http://www.bootdisk.com**, where you'll find disk images of all the boot floppies from DOS 5.0 through to Win98 SE. If you've ever built a machine up from scratch, you'll know just how useful these can be, particularly as you can't actually buy DOS anymore. Other useful things on the site are a raft of CD-ROM drivers, links to assorted computer manufacturers' websites, and an FCC ID registration search (very useful for identifying un-named video and network cards).

There's also system maintenance tools, useful drivers, jumper settings for hard drives and so on. You'll even find some instructions on installing Linux as well. If your PC spends more time with its lid off than on, then this site is worth remembering.

HMMM, NOW THIS could be interesting... **http://spot.fho-emden.de/ftpe.htm** (aka The SPOT Download Archive) offer pages and pages of scientific and technical software for free. To give you an idea of what's on offer, take a look at the categories: chemistry and chemical technology, engineering, mathematics, measurement and instrumentation, optics, cybernetics, physics - and there's more...

Some of the items are just links, but the site is a good information resource, and if you desperately need to calculate the rate of radioactive decay, have to do some Peptide sequencing, or even perform a hyperbolic regression with enzyme kinetics, then this is the place to be.

I might point out that the English site is no longer being updated, and that if you want all the latest stuff you'll have to visit their other site at **http://spot.fho-emden.de/ftp.htm** and be able to read German...

ITS FLAG-WAVING TIME... If you haven't been to *Electronics Australia*'s website for a while, you might have missed a couple of subtle changes. First up is the addition of a reincarnation of our old Tech Q&A forum. The address is **http://www.electronicsaustralia.com.au/cgi-bin/techqa/config.pl**, but it's easier to click on the link from the main menu.

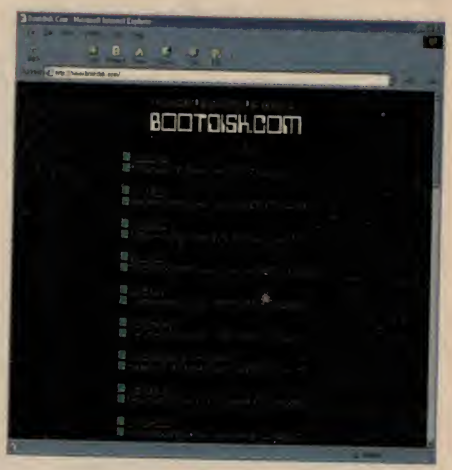
Back in the late cretaceous era when the EA Bulletin Board was all the go, we maintained a special message area where people could ask (and answer) electronically-orientated questions, as well as post information, fixes and ideas that might help other users. After a couple of late nights hacking Perl scripts we've managed to translate it over to the EA website, where we hope it will be even more popular than the BBS version.

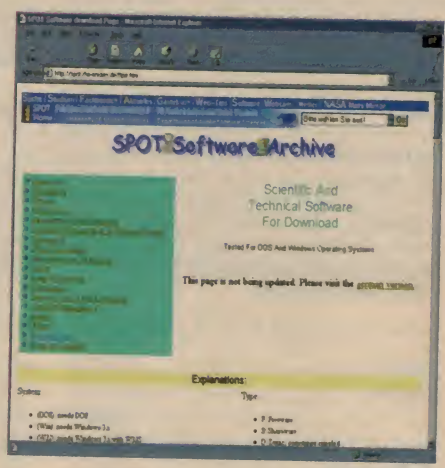
As an extra service, we've arranged for the site to automatically inform you via email if someone replies to your question, so please give it a go and let us know see what you think of it.

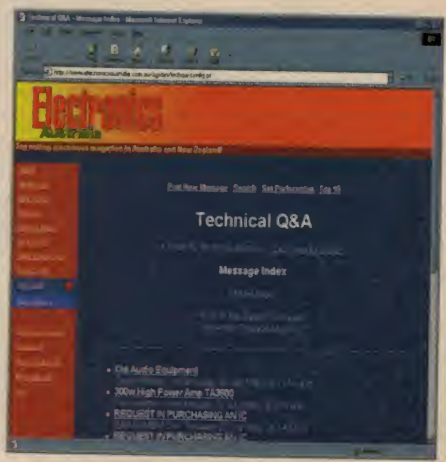
We've also added the EA FAQ, which should answer some of the more common questions we receive from readers. If you have a query, it might be worth checking with the FAQ before contacting us — you'll get your answer sooner, and we'll perhaps be able to reduce the flood of emails we receive every day...

While you are there, be sure to vote in the EA Poll. This is an informal, anonymous mini questionnaire that lets you have your say. Once you've voted, you can see the results, and get an idea of what everyone else thinks. The questions are updated every two weeks or so, and I hope to get an archive of past responses up on the site some time soon.

I'm afraid that that's about it for this month - with the recent changes in staff here at EA I've had little time to search out any more sites; I promise to do better next month. I really do appreciate any feedback on this column, and if you come across anything on the Internet that might appeal to other readers, please feel free to send me the details and I'll include it in the next column.❖







EA Directory of Suppliers

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also, some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

Supplier	State	A	B	C	D	E	F	G
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KEY TO CODING

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Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

Electronics Australia Reader Services

SUBSCRIPTIONS: All subscription enquiries should be directed to: Subscriptions Department, FPC Magazines, PO Box 199, Alexandria 1435; phone (02) 9353 9992 or 1300 656 933.

BACK ISSUES: Available only until stocks are exhausted. Price A$7.50 which includes postage within Australia only. **OVERSEAS READERS SHOULD ADD A FURTHER A$2.50 FOR EVERY BACK ISSUE REQUIRED.**

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PCB PATTERNS: High contrast, actual size transparencies for PCBs and front panels are available. Price is $5 for boards up to 100sq.cm, $10 for larger boards. Please specify negatives or positives.

PROJECT QUERIES: Advice on projects is limited to postal correspondence only and to projects less than five years old. Price $7.50. Please note that we cannot undertake special research or advise on project modifications. **Members of our technical staff are not available to discuss technical problems by telephone.**

OTHER QUERIES: Technical queries outside the scope of 'Replies by Post', or submitted without fee, may be answered in the 'Information Centre' pages at the discretion of the Editor.

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PAYMENT: Must be negotiable in Australia and payable to Electronics Australia. Send cheque, money order or credit card number (American Express, Bankcard, Mastercard or Visa card); name and address (see form).

ADDRESS: Send all correspondence to: Reader Services Co-Ordinator, Electronics Australia, P.O. Box 199, Alexandria NSW 1435; phone (02) 9353 0620. (E-mail to elt@fpc.com.au)

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$55

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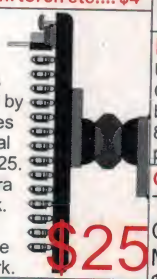
Switches on when it gets dark or can be controlled by alarm system. Kit includes mount ing tray & universal swivel mount.35 LEDs $25. Extra 35 LED pack (3extra packs max) $14 per pack. 140 LED kit:$67 Ideal for use with our monochrome cameras to see in the dark.



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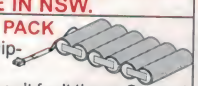
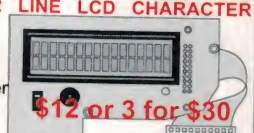


16 X 2 LINE LCD CHARACTER DISPLAY
+ 1M IDC ext. cable, LED, buzzer & switch on a PCB.



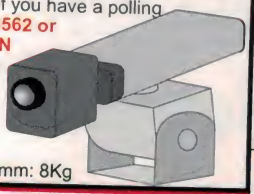
$12 or 3 for $30

TOLL FREE PHONE NUMBER
Sorry but we don't have one but if you call **02-95843564** 24hrs & leave a message & your number we will call you back ASAP at our cost. **(ORDERS ONLY)**

OATLEY ELECTRONICS
PO Box 89 Oatley NSW 2223
Ph (02) 9584 3563 Fax 9584 3561
orders by e-mail: oatley@world.net
www.oatleyelectronics.com
major cards with ph. & fax orders,
Post & Pack typically $6
Prices subject to change without notice

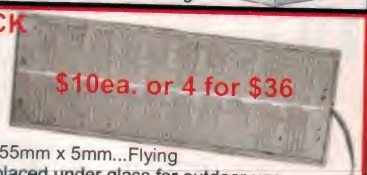
JUNE SALE!!! Did you miss it? Well you were not the only one!!!

The ads were so small that most people missed them So we are going to run it again as the Much **BIGGER** September Sale.To see just what's on sale just check out the September Sale link on our new web page or if you have a polling fax you can see our text list of sale items on **02 95843562 or 02 95707910**. But don't forget our web page **BARGAIN CORNER** where we sell all of our regular specials like runout end of stock & special one or few of items like used security cameras with an incredible zoom lens Canon "C" mount, motor driven zoom lens. zoom, aperture and focus. F2.8 and the zoom range is 15-150mm!! or a large Pan / Tilt unit. 280 x 280 x170mm: 8Kg



SOLAR PANELS ARE BACK

Quality SEIMENS brand Polycrystalline cells. Voc Isc 1W output. 4 panels req. to charge 12V batteries. Specifications: Open circuit voltage: 5.7v...Short circuit current: 0.22A...Peak Power: 1.0W @ 100mW/ sq cm...Dimensions: 160mm x 55mm x 5mm...Flying lead: Dual cable 25cm long. Should be placed under glass for outdoor use.



$10ea. or 4 for $36

240-110 ISOLATION TRANSFORMERS
500 VA, COMPACT METAL CASE, FUSED, MAINS LEAD. $80

NEW*NEW***NEW***NEW PELTIER CONTROLLER:** This kit is a sw-mode design & correctly controls temp. of peltiers to 10A (very efficient design) PCB + onboard parts + new surplus case. $15

NEW MOSFET STEPPER DRIVER
This kit is designed to work below 5V & greater than 35V (higher voltage MOSFETS avail.)Very efficient (very little heat) & work with software like DANCAD etc.(for step/dir-ection signals) & is ideal for CNC projects. It works well with the stepper motors in our famous German printer $45 or$35 with new or previous printer purchase

NEW...PC MOTHERBOARD
UMC-486 CACHE ISA SX 40Mhz. Original package, **486-40Mhz CPU,** booklet & QA report. inc..., 5 X 16 bit & 1 X 8 bit slots, space for 4 X 30 pin & 1 X 72 pin Mem. 220 X 170mm $18

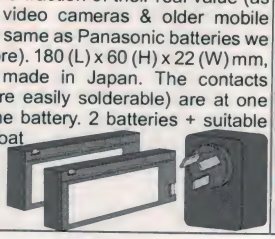
GREAT TEST GEAR BARGAINS
TEKTRONIC 465 100Mhz used CROs $440.....HP 54501A 100 Mhz used digitizing CROs $970... HP3300A used Function Generators with 3302A plug-in $280 **SEE WEB PAGE FOR MORE**

BUILD YOUR OWN COMPUTER CONTROLLED 2/3 AXIS MACHINE
using our now famous $46 surplus GERMAN PRINTER & CNC shareware (DANCAD) Using the parts of our printer that is chock full of steppers, toothed belts, pulleys, bearings etc (see EA June 99). we have plans/notes for $9 (on floppy) & links to find lots of info on the net .

LASER LEVEL
Kit includes laser module with columnating lens plus battery holder plus suitable case plus construction notes $14

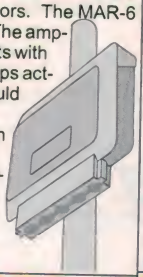
TWO MOTOR LASER LIGHTSHOW KIT
Kit includes motors, mirrors, reversing switch and all electronic components. Can be controlled with a variable DC input.Lots of patterns, flowers, stars etc. $16
Laser module to suit $8

(NEW) 12V / 2.3Ah AUDIOVOX LEAD ACID BATTERY (Model BTR-1900). Priced at a fraction of their real value (as used in video cameras & older mobile phones - same as Panasonic batteries we sold before). 180 (L) x 60 (H) x 22 (W) mm, 0.67Kg, made in Japan. The contacts (which are easily solderable) are at one end of the battery. 2 batteries + suitable 500mA float charger.



$20

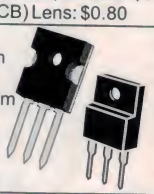
MASTHEAD AMPLIFIER KIT SPECIAL
Based on a low noise (2.8dB noise figure) & wide bandwidth (2GHz) amp IC (MAR-6), this kit can be used as an active TV antenna. The PCB is divided into two sections. The PCB can be cut so that the supply board can be indoors. The MAR-6 available separately $4. The amplifier produces good results with any two metal wires or strips acting for the antenna. It should even work with a coat hanger ! Basic kit with both the PCBs & all on-board parts (K03) $15 Basic Kit + 2 Weather-proof Plastic Boxes + plug-pack: $24 **(ask for your free case with this item)**



NEW ULTRA-SONIC RADAR KIT
Just like the top European cars you can fit a reversing radar that will sound a buzzer or flash a light on your dash to let you know when your car is near another car or object. Features include adjustable range upto1M output to drive relay or buzzer. kit includes PCB plus all on-board components including Ultra-sonic transducers and buzzer for $16

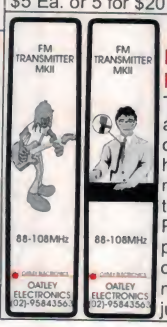
INFRA-RED SHOP DOOR MINDER
IR transmitter & receiver kits (2 separate PCB's), basic range is 20M can be increased by adding a lens. Output to drive piezo buzzers or relays etc. 2 PCB's + all on-board parts: $17. 2 X suitable boxes + 2 swivel mounts: $6, Buzzer: $3, 12A relay: $3 (fits on PCB) Lens: $0.80

MOSFET BARGAINS



IRFZ-44...$2.50
60V/50A/0.028 ohm
IRF-540...$2.50
100V/28A/0.077 ohm
IRFP460...$2.50
500V/20A/0.27ohm
IRF-820...$5
500V/2.5A/3.0 ohm

NEW AUSTRALIAN PLUG PACKS AT BELOW WHOLESALE PRICES
GENERAL ELECTRIC 20VA 14VDC @ 700mA..
AUDIOVOX 9V @ 500mA
AUDIOVOX 12V @ 400mA....
$5 Ea. or 5 for $20



KIT SPECIAL
FM TRANSMITTER KIT / RADIO MIC.
This kit has good range and stability and can be configured as a hand held mic, lapel mic or musical instrument transmitter. Kit includes PCB, all onboard component, suitable small case and lapel microphone with clip. just $17

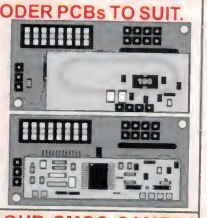
4 CHANNEL VIDEO SWITCHER KIT
This kit can be switched manually or time switched up to 4 audio/video sources. Features inc. VCR relay output for STOP / REC, can be switched with PIR or alarm inputs Add a security channel to your TV with a VHF modulator, watch TV & flick channels & see who's at the door. can be auto switched using PIR units Kit + PCB + all on-bourd parts $50. Optional VHF modulator / mixer $18

PELTIER EFFECT DEVICES
Make a solid state food cooler / warmer for the car etc. with 2 heatsinks, a fan and one of the following. Could be used for cooling overclocked PC CPUs. All 40 X 40mm.
4A △T 65deg. Qmax 42W $25
6A △T 65deg. Qmax 60W $27.50
8A △T 65deg. Qmax 75W $30
Comes with info to build cooler / heater plus data. Some used heatsinks avail.

*****NEW***NEW***NEW*****
DING DONG DOOR BELL KIT
Kit inc. Chip on-board type PCB plus speaker, push button, Battery holder, enough wire up to run 24 Meters & new surplus case. Ideal for commercial or domestic extension bell $10

UHF AUDIO / VIDEO TRANSMITTER KIT
Kit includes all components needed.....
PCB plus all on-board components, connectors, switch, metal case, telescopic antenna, twin RCA A/V lead, all that is needed to complete the full kit. 12Vdc @10mA operation. Ideal for transmitting audio and video around you home.. Complete Kit for just $25 suitable plugcack $5

SAW RESONATOR LOCKED. NO TUNING 433 MHz UHF DATA TX & RX MODULES +ENCODER PCBs TO SUIT.
Many security codes, 4 zones, multi channel. See our WEB SITE for more
TX module $11
TX + encoder $18
RX module $18
RX + encoder $25



AT LAST! A COLOUR CMOS CAMERA WITH GOOD RESOLUTION + BUILT IN AUDIO + FREE PLUG PACK + FREE VHF MODULATOR.
Available with swivel mount or dome mount housing.

$160

$160
BNC connector (video), DC connector (power), RCA connector (audio). 330000 pixel. 330 TV line res. 7-12Vdc 55mA max. INTRO PRICE $160

NEW 12VDC-240VAC/300VAINVERTER
This new design is very efficient, is rated at 300VA constant not peak (with our transformer). It has auto switch on & uses High power MOS-FETS & requires very minimal heat-sinking. Kit inc. PCBs, all onboard parts, 4 MOS-FETs for $35 To save you can use your own transformer or we can supply the Kit + a high quality compact toroidal trans-former + wiring kit + a used large electro-lytic cap. for $89

**** CCD CAMERA SPECIAL ** WITH A FREE UHF MODULATOR**
The best "value for money" CCD camera on the market! 0.1 lux, High IR response & hi-res. Better than most cheaper models. **32 X 32mm $99...** With 1of these lenses pinhole (60deg.), 92 deg.; 120 deg. or for (150 deg) add $10

Test drive the new 7-Series from Jamo

Jamo®

JAMO of Denmark, Europe's largest speaker company, presents the award winning 7-Series range of prestige loudspeakers. Born from 30 years of product development, the 7-Series is considered by leading Hi-Fi critics to be among the finest and most sophisticated speakers available today. Rave reviews from around the world testify to this.

Sculptured lines conceal pure-bread technology. Appearance is further enhanced by the rich mahogany, cherry or black wood grain finish. The two largest models are now also available in hand polished cherry timber. Each of the five models will complement the decor of any living room. The 7-Series will exhilarate you with the detail of your favourite music and thrill you with the excitement of Home Theatre. Our promise is: "Sheer listening pleasure!"

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JMO004